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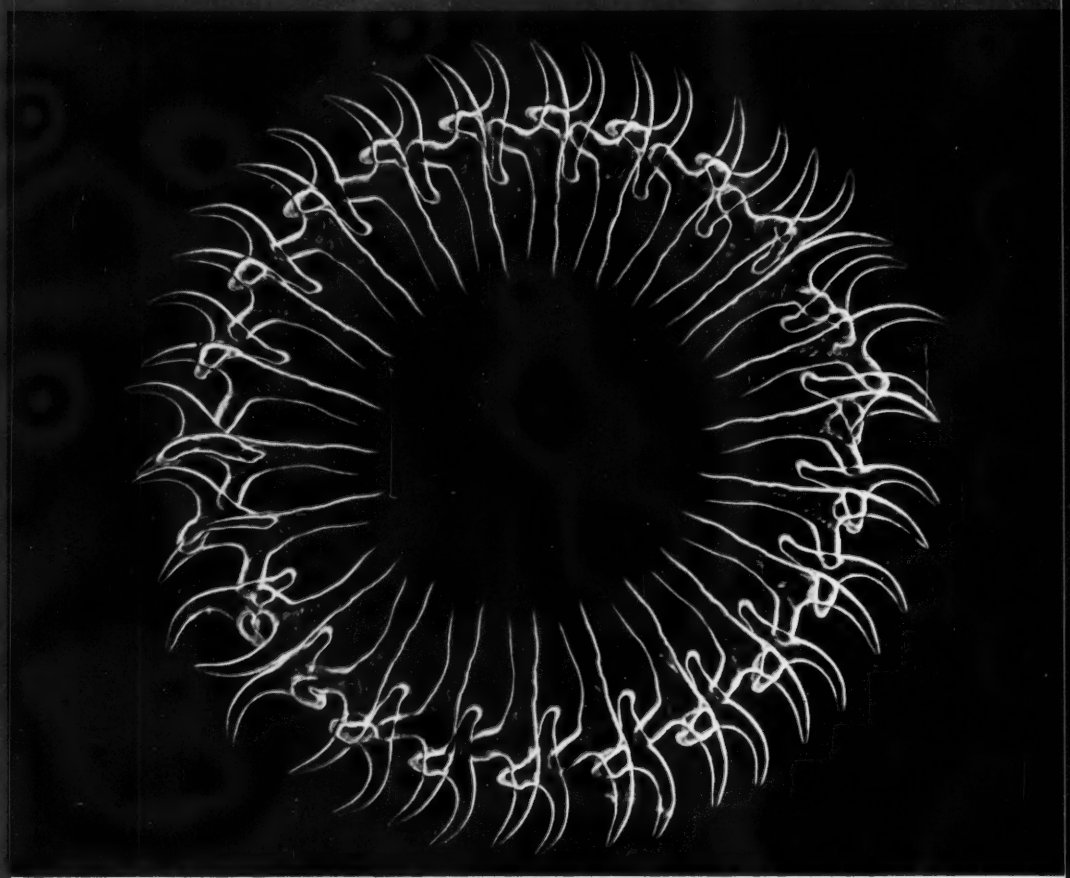

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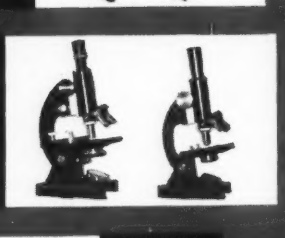

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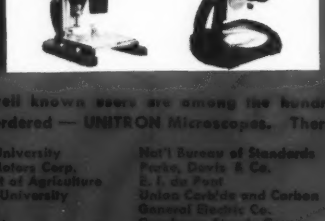

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CONTENTS

The International Advisory Committee on Marine Sciences of UNESCO ..... *Anton F. Bruun* 12

The Scientist as Editor ..... *Theodor Just* 14

A Science of Symbiosis ..... *Clark P. Read* 16

Science and Liberal Education ..... *E. J. Boell* 18

Across the Editor's Desk 21

From the Societies 25

AIBS Reports 26

Education and Manpower 27

Biology Library 29

Know Your Affiliates 35

Ecology Course at Woods Hole ..... *Eugene P. Odum* 36

Indiana Annual AIBS Meeting 37

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COVER. *Taenia pisiformis* hooks by darkfield photomicrography. Taken by W. C. Marquardt, Veterinary Research Laboratory, Montana State College, Bozeman.

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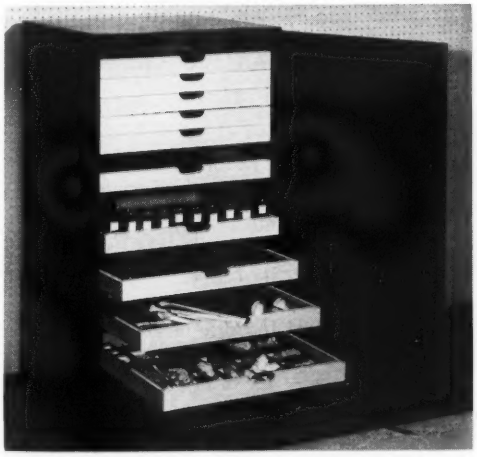

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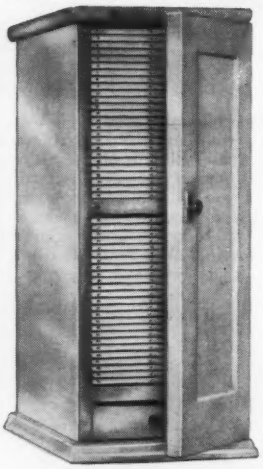

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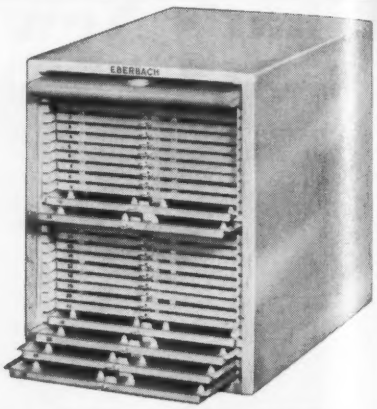

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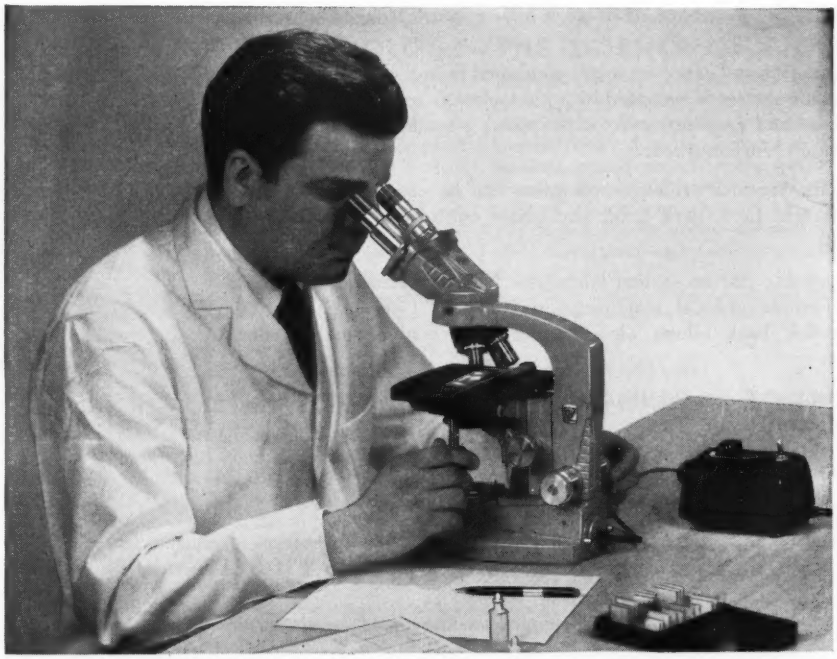

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By MARGARET M. HOSKINS, Ph.D. and GERRIT BEVELANDER, Ph.D., Departments of Histology, College of Dentistry and the Graduate School of Arts and Science, New York University. 1955, 104 pages, 8½" x 11", 174 illustrations. Price, $4.00.

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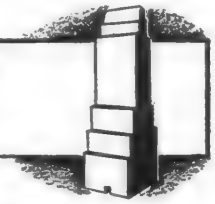

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Where Now?

THE United States alone among cooperating nations has no organized biological program in the International Geophysical Year activities.

The ultimate purpose of a space satellite program must be to get life—man—on a satellite platform. Yet, until a few weeks ago, there was no biologist on the IGY Space Satellite Panel.

The Federal Government recently announced pay raises for "scientists". Biologists, agriculturists and bacteriologists, however, were not included.

Do these three short paragraphs reflect accurately the public image of biology and biologists? The matter of salary increases is a case in point and one upon which I shall expand in some detail.

On December 10th a news story was released to the press by the Civil Service Commission announcing pay increases for "scientists" employed by the Federal Government under Civil Service. Since the news story implied that biologists were not included in this action, the Civil Service Commission was approached directly by AIBS. It was determined that "scientists" included physicists, mathematicians, engineers, some chemists and a number of technologists. Biologists, agriculturists and bacteriologists were specifically excluded.

On December 11th, 12th and 13th I wrote letters to the president and secretary of each professional society affiliated with the AIBS. These letters alerted the society officers to the Civil Service action and pointed out some of the consequences of this action as I saw it. I took it upon myself to write letters protesting this action to the President of the United States; to his science advisor, Dr. James R. Killian; to the Secretaries of Defense, Agriculture, Commerce, Health, Education and Welfare, and Interior; to the Chairman of the Civil Service Commission; and to the Chairmen of the House and Senate Committees on Civil Service, Government Operations, and Agriculture. A number of society officers have written letters of protest and Wallace O. Fenn, as President of this organization, representing almost 60,000 biologists has written to President Eisenhower in protest. Informal protests to chiefs of staff of various congressional committees and government agencies also have been made. At this writing there is a good chance that the Civil Service action will be broadened to include biologists, agriculturists, and bacteriologists. I am informed that a study is being conducted now by the Civil Service Commission on the availability of biologists and the salary scales paid by industry and academic institutions.

Opposition to the Civil Service action was based on a number of points.

(1) Experience gained from the AIBS Placement Service indicates that while there may be no great *quantitative* shortage of biologists at the present time, there are growing shortages in many fields. Moreover, there are *qualitative* shortages in most fields of biology and these are in the areas which are critical in the national defense effort.

(2) This Civil Service action is, in fact, a discrimination against biologists. The financial discrimination is very real but the discrimination against the prestige and the importance of biological scientists is much more significant.

(3) The import of this action upon recruitment of superior students into the biological and agricultural sciences will be serious. The fact that biological scientists are considered second-rate by the Federal Government cannot fail to reflect itself in a reduction in number of students who select biology as a career.

(4) The lowering of morale among federally employed scientists is a direct result of this action and its effects can be seen already.

(5) A policy which places stronger emphasis upon certain fields of science at the expense of others is shortsighted. Science advances in all fields and specific areas cannot be artificially stimulated unless the decision be made upon political expediency alone.

Most biologists will agree that protests of this type should be made and that the AIBS has a definite responsibility to biologists in these matters. The Institute was established for the purpose, among many others, of speaking for biologists on the national scene, and assuredly this Civil Service action has affected all biologists directly or indirectly.

However, protest alone is negative. This one inequity may well be rectified, but the public will have no greater appreciation of biology than it did before. We—the biologists—must "sell" ourselves and our science. We are quietly proud of our scientific achievements in food production and the virtual eradication of famine, in the development of antibiotics and the almost complete conquest of communicable diseases, in the applications of plant taxonomy to jungle survival techniques, to name only a few from a long and imposing list. Perhaps we should not be so "quietly proud". Perhaps we should cultivate more of a taste for "distasteful" publicity and public relations. Perhaps we should not talk only among ourselves about the necessity for using biologists to solve biological problems. We all realize that exposure to atomic radiation and human performance in manned space vehicles are biological problems. But does the layman?

The next several months may be critical ones for science and scientists. At least five congressional committees will be examining the federal approach to science in the post-sputnik era. Biologists have a considerable stake in this. We have an opportunity to publicize what we have done and what we can do. The AIBS is now planning an international symposium on biology in the space age. Tentatively this symposium will be held at the 1958 Bloomington AIBS meetings. An *ad hoc* AIBS committee now exists which has been advising the Office of Naval Research on the design and development of a biological experiment to be included in an early United States satellite. One of the members of this committee has just recently been appointed to the IGY Space Satellite Panel. This committee is planning the program of the symposium. Such a symposium may prove the ideal opportunity to dramatize the fact that many of the problems of space science are biological ones.

The coming months also will see strong pressures being exerted in the Congress to extend the government's predoctoral and post-doctoral fellowships program, to establish a Department of Science and Technology to found a nationally supported Institute of Science and Technology, and many other such proposals. Biologists are vitally concerned in these matters. We should not remain silent as we have done too often in the past. There is no better time than now for the AIBS to become in fact "the voice of biology".

HIDEN T. COX, Executive Director, AIBS

The International Advisory Committee on Marine Sciences of UNESCO

ANTON F. BRUUN, D.Sc., LL.D.

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WHEN a marine biologist reads the letters FAO and learns that they stand for "the Food and Agriculture Organization of the United Nations" he may feel a bit disappointed because he would rather like to have the F to stand for Fisheries. Quite a lot of food—and of a highly nutritious value too—comes from the sea, so no wonder that FAO is very active about developing the marine resources of food in the interest of the hundreds of millions of people who, if not starving, are living on an ill-balanced diet.

But while the applied marine sciences, fisheries research, are highly developed in the countries having a good supply of food, it is almost the reverse with the countries where food is at a critical low level. So it is no wonder that the seed from which the International Advisory Committee on Marine Sciences, IACOMS, of UNESCO, germinated, should originate from a meeting in Djakarta in 1951. Present were Dr. Alexander Wolsky, then representing the UNESCO Science Cooperation Office for South East Asia, Dr. G. L. Kesteven, then General Secretary of the Indo-Pacific Fisheries Council, IPFC, and Dr. J. D. F. Hardenberg who since 1928 had been the leading marine biologist of the then Dutch Indies and who placed his immense experience at the disposal of the new Indonesian Government until he retired some years later.

Nowhere than in the Far East is a development of the fisheries more badly needed, but at the same time we know sadly little about what the resources are and what the possibilities of such development. But a similar condition prevails in most regions of the oceans; it is rather the exception that marine research has passed beyond the exploratory stage, where undescribed species and new features of the sea bottom are not an everyday event.

To pass this stage is a matter of coordinated research, so well exemplified by the first attempt in this field, ICES, the International Council for the Exploration of the Sea, founded in 1902, for the development of the North Atlantic fisheries, and which is of ever increasing importance; but here again: there was a solid foundation of results from many branches of the marine sciences to build on, to apply to the fisheries. And basic research is going on all the time, opening up new fields and quite often getting back fresh inspiration from the applied side.

This close connection between the basic and the applied phases of marine research is symbolized in the collaboration between UNESCO and FAO, the former dealing with the more fundamental aspects of marine research, as it will be explained further on, and the latter having research directly related to fisheries among the activities under its care.

UNESCO's activities relating to marine research are based on the recommendations of the International Advisory Committee on Marine Sciences (IACOMS). Before the first session of the IACOMS in Lima, Peru, 22–24 October, 1956, an Interim Advisory Committee had met in Tokyo in 1955 for a preliminary discussion, which ended up with a number of recommendations concerning the possible role of UNESCO in marine sciences. But first the Interim Committee believed it necessary to consider the character of those sciences, what is needed for their development, and their significance for mankind. Let us simply quote the first three paragraphs:

1. The oceans are international and hence the marine sciences are a natural field for international collaboration. No one country can find out all it needs to know about the sea, except through the cooperative activity of many countries.

2. Great differences exist in the level of development of marine sciences in different countries.

3. Results from the marine sciences have potential application in the development

FIG. 1. *UNESCO Symposium on Oceanography, Session on Information, held at the International House of Japan, Tokyo, October 19-22, 1955. Roger Revelle, U.S.A. delegate, standing.*

of fisheries, in long range forecasting, in the exploitation of marine resources other than fisheries, and in waste disposal—for example, the disposal of radioactive wastes from the peaceful development of nuclear power. But the seas and their creatures are also of great intellectual and emotional interest to human beings, and the study of the oceans enriches human life in other than economic ways.

If it were not for paragraph 2 such international cooperation could easily be organized through the existing international scientific unions within the framework of ICSU, the International Council of Scientific Unions, of which, for example, IUBS, the International Union of Biological Sciences, is a member organization.

As a matter of fact such an organization has just come into being as the Special Committee on Oceanic Research (SCOR), which held its first meeting in Woods Hole, 29–31 August 1957. This committee is meant to find ways to continue and extend the work in the oceans of ICSU's Special Committee on the International Geophysical Year 1957–58. The SCOR consists of 16 members, out of which 4 are biologists, so it may be expected that biology, which plays such a minor role in the activities of the IGY, may now be duly considered to have joined the household of oceanic studies.

There is no doubt that the frontier line of oceanic research is well covered by the SCOR, but UNESCO has to think about its E for Education and the S for Science, so its Executive Board at its 42nd Session, November 1955, established the IACOMS "to advise the Director-General of UNESCO on any problems submitted to it by him concerning the promotion of international collaboration in the marine sciences and limnology so far as this is relevant, and concerning the preparation and execution of marine science research projects within the programme of UNESCO, taking into account related programmes of the United Nations and other Specialized Agencies, in order:

(a) to increase fundamental scientific knowledge as such.

(b) to gather and coordinate scientific information intended for application in improving the living conditions of mankind".

Any effort should be judged from its results, so it is in fact far too early to form any opinion about what will eventually be achieved by the SCOR and the IACOMS. Therefore the following information should rather be regarded as outline of what the IACOMS aims at and how it hopes to assist UNESCO. While the SCOR has just started, and only hardly so, a report of the first IACOMS meeting, in Lima, has been issued by UNESCO (UNESCO/NS/141, 1957) as well as a report of the Interim Committee which met in Tokyo (UNESCO/NS/129, 1955).

The IACOMS consists of 9 members, appointed by the Director-General of UNESCO and chosen after consultation with the FAO from among the members of an International Panel of Honorary Consultants in the Marine Sciences, set up by UNESCO and composed of experts recommended by the authorities of their respective countries. Therefore, the composition is fundamentally different from that of the SCOR, where the ICSU, itself a purely scientific body, is appointing 6 members, and the International Scientific Unions 10 members. However, since experienced oceanographers and oceanic biologists are rather few there is a certain amount of overlapping in the membership of the two committees; this should be an advantage, especially during the first years, in preventing duplication of work and maintaining smooth contacts in the most natural way. The IACOMS members are only elected for a term of three years and may only be re-elected for another consecutive term, thus securing a certain turn-over which the Director-General may use for always ensuring that he has the best advisers for the specific projects UNESCO is stressing at any time.

FIG. 2. *The six metre wide, double sledge-trawl used by the Danish Galathea Expedition, 1950-52, to bring up material from the deep ocean trenches.*

Another mode of contact with other bodies comes about by UNESCO inviting observers from such organizations as FAO, ICES, the International Commission for the Scientific Exploration of the Mediterranean Sea, the International Hydrographic Bureau, the Pan American Institute of Geography and History, ICSU, IUBS, the International Union of Geodesy and Geophysics, the International Association of Physical Oceanography, the Pacific Science Association, and the Pan Indian Ocean Science Association, most of which had observers present at the Lima session of IACOMS.

The members of the IACOMS are: D. V. BAL, Biologist (India); A. F. BRUUN, Biologist (Denmark); G. E. R. DEACON, Oceanographer (U.K.); M. EYRIES, Oceanographer (France); K. HIDAKA, Oceanographer (Japan); L. HOWELL RIVERO, Biologist (Cuba); R. REVELLE, Oceanographer (U.S.A.); D. J. ROCHFORD, Oceanographer (Australia); and L. ZENKEVITCH, Biologist (U.S.S.R.). Revelle, Zenkevitch, Deacon and Bruun are also SCOR members.

Before considering some of the recommendations of IACOMS, especially on biological problems, it might be pointed out that the fundamental difference between the IACOMS and the SCOR is apparent already from the choice of meeting places. With the SCOR the first meeting was in Woods Hole, where highly advanced studies go on, and future meetings will probably be in similar places. The first meeting of the IACOMS was in Lima, and the next was in Bangkok in November 1957 in close connection with the Pacific Science Congress. The intention is quite clear: to stimulate the marine sciences in countries or regions where such research is especially needed, and to encourage and inspire the local scientists about the work they may have started. This falls in line with the Committee's recognition of the importance of symposia or seminars as a direct method of encouraging the development of marine sciences in countries where they have not received enough attention, but it also recommends UNESCO to sup-

port other symposia which seem likely to attract the attention of scientists who have proved themselves effective in other fields and who may not have realized the value of their work to the study of the oceans.

So besides holding its meeting in Bangkok the Committee recommended that a sum of $2000 be allocated to the symposium on "Upwelling" of the P.S.C. Another sum of $4000 was proposed for a symposium in Bergen on "Measurement of Primary Production in the Sea" enabling the organizer, the International Council for the Exploration of the Sea, to arrange it on a world wide contributory basis. As a result of these recommendations UNESCO concluded a contract with the ICES, providing a financial contribution of $2000 by UNESCO.

Similarly the symposium on oceanic circulation, held on the occasion of the meeting of the International Union of Geodesy and Geophysics in September 1957 in Toronto was also given financial assistance to the extent of $1500.

The money allocated by UNESCO for the Marine Sciences programme is as yet on a modest scale and has only allowed the IACOMS to propose economic support to research projects of a regional character in a few cases, all of an oceanographical character.

Every year UNESCO grants about four fellowships in marine sciences to allow students to study up to one year in one of the advanced institutes. The IACOMS members are consulted on the selection of the candidates and their plans of study. Four of the eight awards granted so far have been to students in the different branches of marine biology.

It is, however, very obvious that more effective results can be obtained by having students trained within the region where they will have to apply their new experience, especially in the biological fields. So a 3 weeks training course in marine biological taxonomy and planktonology was organized by UNESCO, February-March 1957, at the Oceanographic Institute of Nhatrang, Viet Nam, with lecturers invited from the Netherlands and Japan. A further development on this line was discussed at the next IACOMS meeting.

This idea is rather closely connected with another project which at the same time would procure much needed observations in but little explored oceanic regions and offer ideal facilities of training young scientists in marine field work. Experienced field workers in oceanology are perhaps the first and foremost prerequisite to be met before this study can advance to any higher level in most countries of the world. So the idea of having an international ocean-going research vessel is being examined. Such a ship, jointly owned by several nations, might appeal to all countries having no ships at all but having great interest in the marine resources; but also countries with a long tradition in this field might join in, especially the smaller nations. Oceanology is a costly science, though much less so than, instance, nuclear physics. UNESCO has had great success in getting the European Center of Nuclear Research started amongst the West-European nations. An international oceanic research vessel could be administered in a similar way; it might even become a much needed permanent instrument in the study of the deep-sea if this becomes the place for disposal of radioactive waste from the atomic power plants.

The first steps of the Committee have had their stress largely laid on the educational and general problems, but as the Chairman in Lima, Dr. G. Deacon, concluded: it was not a bad sign that fairly strong feelings had been aroused. The Committee would be successful only if members give clear expression to their opinions: it was not the scientist's task to steer a careful course so as to avoid difficult problems.

It is barely 85 years ago that the *Challenger* started on the first world-wide study of the oceans. Much has become known since then, but the time has come in which such study can only flourish if it is coordinated on an international scale, like meteorology and astronomy. The two new committees, SCOR and IACOMS, may serve this purpose, so much needed at a time when the coming ten years may tell us more about the oceans than we have learned in the past 90 years.

The Scientist as Editor

THEODOR JUST

Chief Curator, Chicago Natural History Museum

THE anonymous writer[1] of an article entitled "Editors: Relax, Please" begins his discourse with qualified praise: "There is probably no harder-working member of our scientific fraternity than he who has the honor and misfortune to be appointed editor of some worthy but not-too-affluent journal. While there may be an honorarium attached, such an individual usually devotes many hours of his own or his employer's time in reading, editing, proofreading, and generally acting as midwife for other folks' publications. . . . However great the editor's contribution may be, it is the author who gets credit for an article when it appears. The editorial work is unknown or forgotten, though it takes valuable time away from the editor's own researches." After admonishing editors about "editorial fetishism" applied by them to bibliography, minutiae, textual corrections, and other matters, he offers very timely and constructive suggestions about standardization of styles, etc. In conclusion he recommends the following "code" for editors: "(1) Relax; take it easy; don't take your job so seriously. (2) Accept an author's own taste in regard to a multitude of unimportant things. . . . (3) Never make textual changes of any sort without the author's consent. . . . (4) On no account try to rewrite a contributor's article for him. . . ."

A very different approach is taken by W. Furness Thompson, who after scrutinizing scientific journals is prompted to ask "Why don't scientists admit they're human?"[2] He states his question as follows: "Did you ever read a scientific paper that begins, 'For no good reason at all I had a hunch that . . .' or 'I was just fooling around one day when . . .'? No sir! Seldom does a trace of anything haphazard, anything *human*, appear in published reports of research experiments."

One of his answers is important here: "Editors of scientific publications are not without their reasons for the current style of scientific writing. Their journals aren't rich. Paper and printing are expensive. Therefore, it is expedient to condense articles as much as possible. Under pressure of tradition, the condensation process removes the human elements first. And few scientific writers rebel against the tradition."

Clearly editors of scientific journals are facing many real and complex problems, particularly since the end of World War II, as manuscripts are coming in at such an accelerated pace that neither the expansion of existing journals nor the annual creation of new journals can provide adequate avenues of publication. Although no statistical data are available, it can easily be calculated that the annual cost of publishing thousands of scientific journals represents a multi-million dollar business, if not industry. For these and other cogent reasons, it may be well to examine at this juncture what editors contribute to science as a whole and what niche they occupy in the general social scheme.

The most important duty of editors of scientific journals is to ensure a constant flow of new information received in form of manuscripts from their contributors to the readers of these journals. Thus editors

occupy clearly an intermediate position between contributors and readers. In this no-man's land editors are constantly exposed to criticism from both sides. The peculiarity of this position can best be characterized by tracing the steps and events involved in processing and publishing a manuscript from the time of its receipt in an editorial office to the moment when its printed version reaches the reader. In processing manuscripts, editors should remember that they may advise and assist contributors (even to the point of rewriting poorly prepared manuscripts) but that authors alone must assume full responsibility for their papers.

Normally each contributor submits a particular manuscript to one editor at a time. Henceforth contributor and editor enter into a relationship which may prove to be simple or complex. According to practice, the editor may examine the manuscript himself or decide to whom he may want to submit it for critical reading, either a member of his editorial board or a specialist selected *ad hoc*. As soon as the comments of all readers are in, the editor submits these to the author. (Most readers remain anonymous, though in isolated cases they are asked to submit signed comments. This practice is much fairer and should be adopted by more journals.) In transmitting the comments of the readers, the editor should exercise restraint and, if necessary, offer a helping hand. It is always better to enlist the cooperation and good will of a prospective contributor than to discourage him or alienate him permanently. Once a manuscript is accepted for publication, the editor and contributor correspond until all revisions are made and the paper is actually published. Later, the editor may find published comments or discussions of this paper and, if he wishes to do so, bring these to the attention of the author who is usually appreciative of such interest in his work.

In addition, contributors can greatly assist in reducing the editorial burden and thus hasten publication of their manuscripts by observing the "Golden Rules for Contributors" as formulated by the late Professor Nuttall.[3] The contributor is advised to "(a) try to imagine himself in his reader's place, (b) proceed on a definite plan, (c) study compression, (d) revise his manuscript carefully, (e) read and correct his proofs conscientiously." Judging from my own experience, a seasoned contributor is his own best editor and leaves little or no work for the scientific editors. Papers prepared by such contributors are models and always printed promptly and effectively. Less experienced contributors will find it helpful to read the poignant comments of an outstanding editor on "recurrent maladies in scholarly writing."[4] Reading manuscripts aloud is another effective device for detecting poor writing. In preparing a manuscript for a particular journal it is wise to follow as closely as possible its style and format. All contributors should write economically, limiting polemic material to a minimum, but giving maximum attention to clarity, good illustrations, and tabular matter. In this way they can help greatly toward reducing the cost of production in the interest of other contributors to the same journal. Money misspent for unnecessary costs of this kind is not available to other contributors equally entitled to publish in the same journal.

Contributors and editors alike must consult a wide variety of sources in preparing and processing manuscripts. Many scientific journals give specific instructions regarding the preparation of manuscripts, illustrations, and other details. As these instructions are more concerned with the style and format of a particular journal, some generally useful editorial tools may be mentioned here. Biologists will do well to consult the excellent *Wistar Institute Style Brief*[5] containing, among other things, splendid examples of good and bad illustrations printed in black and white, and color. Publishing companies as well as University Presses often publish their own style manuals, as do government agencies such as the Geological Survey. Other tools concern sources of reference and styles used in handling them. Accepted abbreviations of journals can be found in *Biological Abstracts*, *Bibliography of Agriculture*, *Chemical Abstracts*, *World List of Scientific Periodicals*, and similar reference works. Recently the American Institute of Biological Sciences had a special committee survey these styles in an effort to standardize citations.[6]

The special needs of taxonomists in citing literature in connection with scientific names of animals and plants can best be learned by reading representative monographs or other taxonomic works. Editors of journals accepting taxonomic articles should be familiar with the rules of nomenclature to prevent difficulties as far as possible. In the descriptions of many plants (fleshy fungi) and animals (insects, salamanders, birds) the exact colors must be given. Unfortunately, none of the available color charts is entirely satisfactory and gives the names of colors in several languages, including Latin. The problems of chemical nomenclature are best solved by following some standard source or main reference. As statistics is now a widely accepted scientific tool, acquaintance with its principles and requirements is useful to the contributor and editor alike. Although few, if any, new species of animals are now being described in Latin, the preparation and inclusion of a short Latin diagnosis for each new entity (taxon) of the plant kingdom is mandatory on the basis of the *International Code of Botanical Nomenclature*.[7] The editor should acquaint himself with this form of Latin or consult a colleague familiar with it rather than a professor of classical Latin. Frequently the editor can help in selecting correct or euphonious names for new taxa and prevent grammatical errors from appearing in print. Clearly the tools of the contributor and editor are thus quite varied, but should include a good grammar, manual of writing, dictionaries of English and foreign languages, and other pertinent reference works.

Preparation of manuscripts and editorial procedure vary of course in regard to the kind of article in question. Most manuscripts now being submitted to scientific journals represent undoubtedly the results of original research. They may be long or short depending on the subject, the type of treatment chosen by the author, or other reasons. Normally governmental and official reports must first be cleared with the proper authorities before they can be submitted for publication. Such reports frequently require complete rewriting as official procedure of presentation commonly runs contrary to accepted form of presentation in scientific papers. If an article represents the result of a certain phase of investigation, it may be followed by others in the same series. Also, the limitations put on members of a society in regard to their manuscripts restrict an author to a certain number of pages per year. He may choose to pay the cost of additional pages himself, secure financial assistance from an outside source, or decide to break up his manuscript into several consecutive parts. In the last case the manuscript will be published on the instalment plan, an unfortunate but commonly used system of handling longer papers. Some subjects are more easily presented in short papers than others, permitting more frequent progress reports. Short notices and news items are also accepted in many journals and readily absorbed. Review articles are carried in journals devoted entirely or in part to such contributions. Of necessity, they are often longer than articles reporting original research and thus involve both policy and funds. More and more articles appear signed by several authors. No objection can be raised to cooperative research except in case of very short papers attributed to a group of authors. Many journals carry book reviews, a distinct and useful feature if well handled. The art of reviewing books has been the topic of a scholarly article by the late Professor Sarton[8] and need not be discussed here.

Although from time to time contributors[9, 10] feel compelled to voice criticisms of certain editorial practices and incidents, such instances are fortunately very rare compared with the large number of articles processed and published every year in scientific journals. Thus common sense and cooperation undoubtedly prevail in the vast majority of cases.

Another exceedingly important aspect of an editor's duties and work concerns the policy adopted by him or his sponsoring society regarding the nature and contents of the journal for which he is responsible. For example, general journals such as *Science*, *Nature*, *Experientia*, and others carry articles of all kinds, news items, reviews, and advertisements. The editorial policy adopted for such journals is obviously quite different from those guiding most scientific journals devoted to specialized fields and interests. In addition to these specialized journals, in the United

States usually owned by societies promoting research in these fields, many journals and serials appear under the auspices of universities, museums, institutes, and other privately managed institutions or represent private enterprises. So-called one-man journals, once so fashionable, are now historical curiosities, as they have lost their place with the passing of the frontier days.

Recent years have seen a striking change in the physical make-up of many American scientific journals, when their editors adopted double columns in preference to the conventional single column pages. Most of these changes stem from the detailed study made by Professor Schramm[11] who carefully analyzed printing costs, psychological benefits accruing from reading double column pages, and other relevant questions. The historical side of this problem was treated by the late Professor Sarton[12] in a timely essay on early forms of printing. Although double columns greatly increased the capacity of most journals, the editors of these journals did not get proper help to cope with their added burden, a fact not well known and recognized.

Contrary to the views held by our anonymous writer, editors of scientific journals undoubtedly observe the following ten basic rules: they (1) function as public servants creating the all-important liaison between contributor and reader through the medium of their journal; (2) work for the benefit of the maximum number of people and the advancement of science; (3) keep abreast of their field or fields, enabling them to voice competent opinions and recommendations; (4) follow a sound long-range policy; (5) maintain high standards commensurate with the aims of their society or sponsoring institution; (6) act as understanding and helpful critics rather than as sarcastic despots; (7) edit manuscripts meticulously rather than pedantically; (8) possess a good working knowledge of printing, engraving, and costs pertaining to them; (9) allocate available funds with utmost care and consideration for the greatest benefit of all concerned; and (10) use ingenuity and tact in all difficult situations.

Beyond these traditional responsibilities editors are increasingly concerned with finding adequate financial support for scientific journals. As costs of printing and engraving operations are constantly rising, editors find themselves confronted by new and pressing problems. They must either raise more money and/or shift to new printing techniques. But this is not their only trouble. The increased output in all fields of scientific research, especially since the end of World War II, creates an ever mounting pressure and demand on the pages of existing journals. While higher costs can in part be met by increased membership dues and subsidies from private and governmental sources, the influx of new manuscripts is apt to exceed the available pages and resources of many journals. New printing techniques may alleviate this pressure temporarily but provide no permanent substitute for conventional printing. Few editors would like to cut the size of their journals in the face of such legitimate demand. Editors are thus confronted by problems far more serious than the standard ones of "editing." In addition, greater demands are constantly being made on their personal time and effort. In spite of modern business methods and technical improvements, scientific editors carry a large share of the ever increasing burden of dispersing knowledge and thus contribute materially of their time and energy to the progress of science by sacrificing some of their own research interests and opportunities. Their contribution is thus real, unselfish, and unrivalled.

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A Science of Symbiosis

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UNDER the general term of symbiosis, which means nothing more than organisms living together (De Bary, 1879), a plethora of different kinds of relationships exist in nature. These associations range from mutualism to commensalism and parasitism and include representatives belonging to almost all groups of organisms. In addition to the variation in the nature of the relationship from the standpoint of interdependence, there are great ranges in the degree of physical intimacy of these relationships. Intimacy ranges from the external types of contact, seen among the plant lice, fleas, and isopod crustaceans, through almost all conceivable intergrading varieties to the types of parasitism observed in the viruses. Because of the rather obvious medical, veterinary, agricultural, and conservational problems posed by many of these relationships a considerable amount of attention has been devoted to them from these standpoints. Depending on the nature of the particular groups of symbiotes and the ease with which they can be maintained in the laboratory, the fields concerned have developed in rather different ways. For example, the virologist, unable to cultivate his organisms free of cells, has by necessity worked with tissue cultures, whole animals, or in recent years, with bacterial hosts. The animal parasitologist, concerned with the helminths and protozoa, has been so fascinated with the intricacies of the life cycle and with the medical and agricultural applications of such information that this field has developed primarily in these areas. Bacteriologists have been concerned, in large part, with studies on organisms *in vitro*. The development of the field of bacterial physiology and biochemistry has dealt almost entirely with the behavior, chemical and otherwise, of these organisms *in vitro*. Dubos (1954) has recently pointed out that, with all our information on the biochemistry of bacteria *in vitro*, we know little more about their behavior *in vivo* than in the days of Louis Pasteur. The most significant strides in elucidating the physiological relationships of symbiotes and their hosts have been made in plant pathology, principally in the area of mycology. In other fields, only recently has some enhanced activity been evident in biochemical and physiological attacks on

the combined ensemble of host and parasite or symbiote.

It would seem that the time may well be ripe for the development of a more concerted research and teaching effort aimed at the physiological basis of the relationships between symbiotic organisms. In a presidential address to the American Society of Parasitologists, Huff (1956) indicated that the greatest deficiencies in the field of animal parasitology reside in the fact that there are few, if any, generalizations which can be made concerning the organisms studied in this field. Those which can be made seem to be associated with the taxonomic distribution or zoogeography of animal parasites. We know a great deal, for example, about the apparent morphological adaptations for parasitism, such as special organs of attachment, special organs presumably for feeding, and descriptively, the mechanisms for entering the host. We have considerable information of a descriptive variety dealing with periodicities observed in parasitism, including microfilarial periodicity, periodicity of pinworm migrations, reproductive periodicity in flagellate protozoa of termites, and the seasonal periodicity of certain blood infections in birds and tapeworm infections in fishes. Many of the textbooks contain statements to the general effect that parasitic animals are degenerate with reference to the nervous system and other organ systems. However, when we compare the parasitic animals with their free-living relatives, it is frequently rather difficult to find a specific feature which is "degenerate". Most of the special features of the morphological variety observed in parasitic organisms have their counterparts in free-living organisms which are related. The more fundamental aspects of the adaptations for parasitism are undoubtedly those which have a physiological basis. The tropic and trophic responses of parasites to the environment furnished by the host, the biochemical adaptations necessary for living in a host, the possible alterations in adaptive plasticity which lead to physiological host specificity, the actual pathways of energy metabolism in parasitic, as compared with free-living animals, are uninvestigated aspects of the host parasite relationship. When I say uninvestigated I am using a relative term and do not wish to slight those workers who have made an attempt to tackle some of these problems. In what ways are parasites dependent on a host? We know, for example, of the specific requirement for a vitamin-containing cofactor in the influenza bacillus. There is evidence for a requirement for Coenzyme A and Coenzyme I by a malaria parasite. Some trichomonads have sterol requirements. Trypanosomes are thought to require hemin. There is some evidence that many parasites have an absolute requirement for carbohydrate for growth and reproduction, a requirement which is apparently rare in free-living animals. Evidently, there are variable requirements involving nutrition. However, there is little question that factors, other than those strictly nutritional in nature, are probably involved in the dependence on the host. We have little information on the microecology of parasitic organisms; the physicochemical reactions of the parasite to the physical pecularities of the environment furnished by the host are uninvestigated. Neither Lewis' hypothesis of the importance of nutritional balance in parasitism (1953) nor Garber's nutrition-inhibition hypothesis (1956) have yet been submitted to rigid experimental testing; the data available from a few experiments with plant parasites are highly suggestive. Studies on the short range reactions of annelids living as symbiotes on other animals indicate specific chemotropic responses. Mallophagan preferences for particular kinds of feathers also indicate specificity of a tropic variety. These isolated instances which are mentioned merely indicate that this is a fertile field for investigation. A short time ago no one would have dreamed that diphtheria is a disease caused by virtue of the fact that the bacterium involved is susceptible to infection with a virus. Appreciation of this relationship and its importance from the applied standpoint arose from other studies on bacterial viruses which were regarded as of little or no practical significance. A whole field has rapidly developed from these initial findings.

I wish to indicate mechanisms by which impetus might be lent to a more fruitful approach to this poorly known area. It is suggested that a department or institute be set up in some major university in the United States, this department being concerned with the physiology or physiological basis of symbiosis. Placing such a department in a university rather than elsewhere would have certain advantages. First, the relative freedom of action in the university community should be fertilizing in effect. Second, the members of the department could have the stimulation afforded by contact, presumably continual contact, with a graduate student program. Third, individuals from other disciplines could be consulted. This would be a necessity, since a department dealing with this subject would obviously cut across fields. Such a department should contain individuals interested in animal-animal, plant-animal, and plant-plant associations; the terms plant and animal should not exclude the viruses. Hitherto, people interested in these different kinds of organismic relationships have been separated professionally and institutionally. This state of affairs has its historical origin in the fact that those individuals who were interested in plant relationships with either plants or animals were originally identified with botany while those who worked with animals that live in or on animals had their origins in zoology. The bacteriologists have developed from somewhat separate origins. If generalizations concerning symbiotic relationships can be developed, these barriers must be broken down. A mechanism alternative to setting up a department or institute would be the creation of an interdepartmental committee on symbiosis in one of the larger universities. There is some hesitation in suggesting the establishment of a committee. Such establishment sometimes leads to nothing more than recognition of a need. To meet the needs, such a committee should be empowered to organize courses, sponsor research, and grant degrees. This method has been used with some success in the development of biophysics in a few institutions.

It must be emphasized that I am not suggesting the splitting off of a new field since this, rather than being a new field, would be a combination of disciplines, a symbiosis, having an aim which is synthetic in nature. In view of the recent attention and concern about the value of making generalizations in fields of science, such a department would seem singularly appropriate. I would suggest that the benefits of such a department or institute might be felt in many areas not directly concerned. The areas of biological control, problems of world nutrition, population manipulation, and perhaps even some areas of direct human relationships might well be better understood.

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Science and Liberal Education

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ONE of the chief characteristics of the present age is the ascendency of science. Never before in history has any agency of peace or war exerted so profound an influence during an equal interval of time as has science within the past five or ten decades of human existence. In all areas of the world, but especially in the Western World, science has contributed immeasurably to our material well being, our intellectual development, to our happiness and our health. Our knowledge of the physical world and of the cosmic organization of which it is a part has been greatly extended; control of the atom has brought a source of power whose dimensions stagger the imagination. In chemistry, progress can be assessed by the tremendous developments in organic chemistry—in textiles, synthetic drugs, fuels, and plastics, and also in our understanding of protein chemistry and enzyme action. In biology, we have a consistent and logical account of the origin and development of life on this planet. We know the genetic basis for variation and how variations with adaptive significance have led, through evolution, to the origin of species. Progress has also been striking in applied biology. Our food supply has been increased to a remarkable extent by the development of hybrid crops and through genetic selection of strains of domestic animals capable of greater meat, or milk, or egg production. Control of unwanted vegetation and selective nurturing of useful plant growth by hormones and chemical agents represent other areas in which progress has been made. Artificial photosynthesis of carbon dioxide and water into carbohydrate, a process on which green plants have thus far enjoyed exclusive patent rights, may be just around the corner.

In medicine, likewise, progress has been truly phenomenal. Many epidemic diseases, which only a few years ago exacted heavy toll from children and young people, have been effectively controlled. At present, therefore, the average life expectancy in America is only a fraction of a year short of the Biblical three score years and ten. Approximately 30 years ago, the sulfa drugs were discovered; then came penicillin, and in turn the galaxy of even more powerful antibiotics. Only a few years ago, cortisone and ACTH were introduced. We still do not know how they work and much research must be done to discover precisely how they protect the body during stress, but it has been reported that they are used in the treatment of as many as 100 diseases and are the agents of choice in 45.

During the past two decades, DDT and atabrine were developed so that now through control of mosquitoes and destruction of the infective organism, malaria has been essentially wiped out of vast areas of the world and this once widespread disease may disappear completely in another decade. Today, the fear of tuberculosis, if not completely gone, is greatly lessened, and, within the last five years, the disease that has caused more distress in the minds of parents than any other — polio — has been substantially whipped. The present vaccines, used so extensively in this country and in others, have afforded impressive protection against the polio virus.

The use of drugs in the rehabilitation of the mentally ill represents yet another scientific achievement of great current interest and significance. And it seems safe to predict that the next few years will witness the development of new chemical agents that will permit control over physiological processes in the nervous system with the result that mental stability and normal mental powers will be vouchsafed for many who would otherwise be unpredictable and incompetent.

Remarkable progress has been made in the field of cancer. During the past decade through a combination of early detection, new surgical procedures, and more powerful sources of cancer-killing radiations, the lives of many persons normally doomed to die have been preserved.

So striking and significant have been our developments in science and technology that the historian Toynbee stated recently that the first half of the twentieth century would be known not so much for the two World Wars which ravished this planet as for the development of a new freedom — freedom from destitution and disease. In this country and in many other areas of the world, employment is maximal, and the economic condition of labor is at an all time high. This is a time of great material stability; a time never before surpassed so far as man's corporate health and wealth are concerned. And progress in science, pure and applied, has to a large extent brought this condition about.

The advances in science that have characterized the past two or three centuries and especially the last 50 years, have been important not only because of their intrinsic qualities but also because they have contributed, through their application in technology and engineering, to the creation of an environment in which social, intellectual, and even spiritual development can flourish. Science and technology, through the substitution of machines and kilowatts for human hands and human energy, have provided man with more and more time to spend in activities other than those immediately concerned with livelihood. It may be admitted that the increased availability of leisure for large segments of the population has led to over indulgence in cheap and shoddy pastimes. But it can also be claimed that genuine and effective expression of the highest traits of humankind, such as love, integrity, loyalty, and compassion and the recognition of the dignity of human personality can occur best is an environment and under a socio-economic system in which there exists a high degree of control over matter and energy.

Nevertheless, the increase in scientific knowledge and the technological accomplishments which characterize this age are sometimes viewed with misgiving and concern. There are those who feel that science and technology, by increasing of dependence on products and machines, are making materialists of us all. One may concede that ofttimes too much attention is paid to material tinsel—to chrome plate and horsepower, to 21 inch picture tubes, to the latest gadgets and labor saving devices. But may it not be argued that the housewife can at least as well contemplate what is good and true and beautiful while her china and silver are being scrubbed in a dishwasher as she can with hands immersed in suds at the kitchen sink. Science and technology, far from enslaving man to materialism, actually can liberate him and enrich his life.

There can be no doubt that science and its offspring technology and engineering are integral parts of modern life. It has been abundantly demonstrated, for example, that in matters relating to our military defense, we have become completely dependent on science and the activities of scientists. Not only for our military defense, however, but also for the much more important purpose of insuring security so far as health, comfort, and economic well-being are concerned, science is essential. To maintain our standard of living; to continue to develop and to exploit atomic energy—especially for peaceful purposes; to persist in the battle against sickness and disease; to provide the special needs of industry, scientists and technologists in unprecedented numbers are required.

That we require scientists to engage in various areas of applied science is clear to many. What is not so readily apparent is that we also need large numbers of scientists and substantial support for their work in so-called fundamental or basic science which is without immediate prospect of practical application. Such scientists, through their fundamental discoveries, contribute to our intellectual development in an important area of knowledge and lay the foundations for the applied science

and technology of the future. Indeed, without substantial growth in the broad base of fundamental science, progress in applied science cannot go on.

Relatively few individuals offer objection to supporting work which holds the prospect of immediate reward. Basic research is often disparaged, however, because it is regarded as a tremendous expenditure of time and money for results which have no immediately demonstrable utility nor application. Of such an attitude the Rev. Thomas Sprat said in 1722 in his *History of the Royal Society:* "It is strange that we are not able to inculcate into the minds of many men the necessity of that distinction of my Lord Bacon's that there ought to be experiments of light as well as of fruit. It is their usual word, What solid good will come from thence? They are indeed to be commended for being so severe exactors of goodness. And it were to be wished that they would not only exercise this vigor about experiments, but on their own lives and actions, that they would still question with themselves in all that they do, What solid good will come from thence? But they are to know that in so large and so various an art as this of experiments, there are many degrees of usefulness: some may serve for real and plain benefit without much delight; some for teaching without apparent profit; some for light now and for use hereafter; some only for ornament and curiosity. If they will persist in condemning all experiments, except those which bring with them an immediate gain and a present harvest they may as well cavil at the providence of God, that he has not made all seasons of the year, to be times of mowing, reaping, and vintage."

In the long run, as Warren Weaver, of the Rockefeller Foundation, has pointed out, it is impossible for science to remain impractical. And as we look about through the history of science we encounter many examples of the practical value of scientific work which appeared for years to be remote from useful employment. "The Salk poliomyelitis vaccine was possible only because of a preceding half century of fundamental work, some of it quite outside of the virus field. . . . Of the earlier steps one of the most important was development of a simple method of tissue culture by (Professor) Harrison at Yale."

No thoughtful person can deny that scientists are needed at the present time in ever increasing numbers. Is it not strange, therefore, to find that the supply of scientists in this country is not nearly keeping up with the demand? The factors responsible for our failure in this respect are complex and manifold, and I can mention but a few.

One element of extreme importance is the inadequacy of the science programs and the poor science teaching in our secondary schools. Many high school students, a large fraction of whom have such natural aptitude for science that success in scientific careers could be safely predicted, are not being attracted to science because of insufficient or inefficient instruction in the basic sciences in school. *The New York Times* has pointed out, in describing the science situation in our schools, that "A sense of shame must be felt by any thinking citizen who studies the state of science teaching in our high schools. . . . (and) it seems almost incredible that such a situation should exist today (when) we live in that most remarkable period in human history when science and technology, with mathematics as their foundation, have revolutionized and are revolutionizing our lives at an unbelievable pace."

Poor high school teaching of science is in part the result of inadequate numbers of good teachers and an oversupply of teachers who are highly trained in pedagogical methods but insufficiently educated in subject matter. Unfortunately, this situation is aggravated and perpetuated by the fact that the standards set by professional educators as the basis for teacher certification place undue stress on training in *how* to teach and too little on *what* to teach.

There is evidence furthermore that the low level of compensation fails to attract or to hold many individuals who are qualified by inclination and aptitude to teach. Many good teachers cannot afford to make the financial sacrifice necessary in the profession and are being attracted to other more remunerative fields. That the teacher in school is being underpaid is convincingly demonstrated by a report of the National Education Association that 73% of male teachers and 17% of the women have to supplement their teaching salaries with other income. Good teaching in the sciences, or in any other field, is not something which can be had at bargain basement rates.

Another reason for the inadequacy of the American school in supplying a proper foundation for science in the view held by certain professional school administrators that our high school programs have concentrated "too much on the intellectual aspects of education." As a consequence, the curriculum is loaded with shoddy and trivial courses which provide only a counterfeit education, and the more rigorous and basic courses are all but crowded out. The Senior schedule of courses submitted by one student on applying for admission to Yale consisted of Journalism, Physical Education, Speech, Chorus, Marriage and Family, and Personal Problems. It is shocking to discover that in the college preparatory programs such basic and essential subjects as literature, languages, history, mathematics, and science are being supplanted by courses in Basket Weaving, Exploratory Language, Commercial Law, and Automobile Driving.

The result of this type of education is clear, says Dean William C. DeVane, of Yale College. "Students now graduate from our high schools unable to write, read, or speak English; unable to cope with mathematical problems which require algebra or trigonometry in a time when we are in dire need of these commodities." Little wonder is it, then, that students have insufficient background for development in the sciences when they come to college. It is significant that many high school students themselves feel that they have been shortchanged in school, for the results of a recent survey show that "forty-five percent of high school students believe their school background is too poor to permit them to choose science as a career."

Another reason why young people in school and college are not being attracted to careers in science stems from an attitude, unfortunately widespread among our population, that scientists are a menace and a danger to society and are not to be trusted. Accordingly, the prestige of science and scientists is low and the place of science in American education is far from secure. A recent study conducted by Purdue University on a large sample of representative high school young people showed that students feel that scientific occupations have no dignity, that scientists are usually evil men, and that only geniuses are competent scientists. And the report goes on to say that these attitudes of high school students reflect those of the population as a whole.

This unsympathetic attitude towards science stems from many sources. They include the stifling effects of teachers in school who are not qualified and not prepared to teach science; they include the influence of counsel, well intentioned and often misguided, that tends to insulate the student in school and college from rigorous intellectual exercise; they include fear and hostility in the minds of many.

Antagonism to science arises too from the attitude of a group which, unhappily, includes some fellow occupants of the ivory tower. These individuals do not actively oppose science. They simply dismiss it as being relatively unimportant or as crass and materialistic. They admit that science has utility, as a practical art, so that "the almond tree may flourish," or to provide relief "when the grasshopper shall be a burden, and desire shall fail." But they regard "illiteracy in science and technology (as) much less dangerous for the citizens of a democracy than illiteracy in history, politics, or morality". I contend that we cannot be illiterate in any field of knowledge without narrowing and impoverishing ourselves. Surely the cultivated, educated person needs to know something about science—its domain, its methods, its philosophy, and its limitations. How else can he be prepared to think and to act intelligently on some of the knottiest problems that have ever confronted mankind?

Another source of opposition to science is a growing spirit of anti-intellectualism which ridicules or seeks to censor and to control the thoughts and the beliefs of men. This is a spirit which stifles all liberal learning, and science is not the only discipline that has felt its curse. However, the anti-intellectuals represented by reactionaries, by narrow politicians, and by

some newspaper writers have, in recent years, subjected scientists in particular to ridicule, to unproven accusations, and to character assassination. Perhaps in America, more than in any other civilized country, the intellectual is often the object of scorn or derision.

The position of science is further shaken by the contention of some that science has gone too far and must be curbed. Although science has contributed to our physical well-being, say these critics, it has also brought us the evils of the atomic age and it may bring us even worse dangers. Science *has* made us healthier and more comfortable, it enables us to live longer—if not more happily—to live long enough perhaps to witness our own destruction. Science that can do this is not a blessing but a curse.

But I should like to ask whether it can reasonably be contended that those who produced the means of atomic warfare have been responsible for creating the problems which now face the world? The answer is "no". The scientists have not created a new problem. "They have," in the words of Einstein, "merely made more urgent the problem of solving an existing one." But even if we accepted the charge that scientists are responsible for the present dangers to mankind and to civilization, whom are we going to blame? Shall we pillory Seaborg, and Fermi, Rabi, Conant, and Bush? What shall we do with Nils Bohr who drew for us the picture of the atom? Or with Einstein whose genius perceived the mathematical relationship between matter and energy? And what of those who developed the aircraft by means of which delivery of the bomb was possible? Shall we bring Daedalus and Icarus to scorn for making man dream of the glories of flight, or Leonardo for bringing it nearer reality, or the hundreds who failed before the success at Kitty Hawk?

It is unfortunate that we were at war when atomic power was first released. Had it been a peacetime occurrence, and used first to provide power for ocean liners or to generate electricity, or as a means of killing the cells of cancer, would the critics of science still cry for science to halt until morals catch up? It should be emphasized, as Whitehead has, "that material power is ethically neutral." Evil lies not in things, but in the heart of man where are conceived the uses for the things he has created.

A great humanist, Professor Norman Foerster, has said that those who depreciate the sciences have forgotten that the source of the ills from which we suffer "is . . . not in any material structure raised by the genius of man, but in the deepest depths of the human soul where selfishness and greed, hatred and fear have displaced 'beauty and goodness'! The evil from which we suffer," he says, "lies in the realms of the humanities. It was not caused by scientists and engineers and will never be destroyed by them." The Scriptures remind us that "Whatsoever thing from without entereth the man, it cannot defile him, because it entereth not into his heart. But that which cometh out of the man that defileth the man. For from within, out of the heart of man, proceed evil thoughts, adulteries, fornications, murders, thefts, covetousness, wickedness, deceit, lasciviousness, and evil eye, blasphemy, pride, foolishness. All these evil things come from within and defile the man."

This brings me now to the main and final point—the place of science in liberal education. The concept of liberal education arose in Greece at the time of Plato, where it referred to the collection of studies "becoming to a free man"; the slaves were taught the professions and the vocations. They were the narrow specialists. A sound program of education for free men, even in the modern world, is best based on the liberal arts including, and with historical justification, substantial work in science. The function of liberal education is to provide the means of knowing and assimilating that which is most valuable of the knowledge and wisdom of the past, so that the individual can best interpret and evaluate the events of the present. Man can incorporate the experiences of others directly into his own, and education makes it possible for him to profit not alone from his own mistakes and triumphs but also from the mistakes and triumphs of others.

The liberal arts supply more than facts; they also provide acquaintance with different methods of thought and different techniques for solving problems. And certainly, one of the most important of these is the *scientific method*. We may consider, then, that a liberal education equips the individual with the ability to solve problems reasonably and logically, not by supplying a fund of facts or set formulas which can only be used, like the interchangeable parts of a machine, to yield a stereotyped answer, but by supplying the mental tools with which a custom-built solution to a particular problem can be fabricated. The liberal arts are valuable not altogether because of their specific content, but because they nourish the individual's powers of reason, judgment, and imagination. And these can be used creatively to advance knowledge and to increase understanding.

The proper objective of liberal education is the development of men and women with minds trained to dissect the problems which confront the individual and society and capable of resolving them through the application of appropriate techniques. And this objective the college can best secure by seeing to it that the student is provided with broad and thorough knowledge of all the fundamental disciplines.

The concept of a broad and liberal education does not rule out a program of study which includes or even concentrates on science. Historically, the liberal arts have always included science. In the Universities of the late Middle Ages, the student was educated in the seven branches of learning, represented by a basic group of grammar, rhetoric, and logic, and a somewhat-more-advanced set of four disciplines including arithmetic, geometry, astronomy, and music. These were the liberal arts, three of the seven fields representing science; and they were prescribed for every student, for a broad education in fundamentals was regarded as an essential foundation for later study in the professions. During the 12th and 13th centuries, the content of the liberal arts was immeasurably enriched by a great flood of knowledge — particularly scientific knowledge — which swept into Europe from Italy and Sicily, but especially from the Moors by way of Spain. The Mohammedans brought with them not only the system of Arabic notation, but also the geometry of Euclid, the astronomy of Ptolemy, and the writings of Aristotle. Although in content the medieval curriculum was anything but substantial by modern standards, the concept behind it—that of providing the student with competence in all existing fields of human knowledge and achievement—has never been surpassed.

I have given this brief historical account of the development of the liberal arts curriculum to show that, contrary to the widely current notion, science is not a recent intruder — a Johnny-come-lately — into the field of liberal studies. Actually, the early liberal arts curriculum was permeated with science. The humanities and the sciences complemented each other, and there was no conflict between them.

I plead for a recapturing of this view; that science may be restored to its rightful and appropriate place in school and college. Only in this way can we hope to recruit and to train the scientists which we so sorely need.

Matthew Arnold has said, "the aim and office of instruction is to enable a man to know himself and the world." The dimensions of this world can be described both by the humanist and the scientist. Science provides man with the faith that his world is not chaotic and capricious but is based on order. Hence, the scientist strives by the powers of disciplined imagination, by all physical aids to the senses, and by the refined techniques of logic to see that order—whether on the level of the cosmic or the atomic, or in the realm of the living or the non-living; to see it as accurately as possible, to describe it faithfully, and to percieve the relationship of what he sees to the whole of what man knows. Is not the aim of the scientist, therefore, the same as that of the poet, or of the artist, or the philosopher, or the historian? All of these seek truth; all strive for understanding. Their techniques are different, and the fields in which they search are different, but their ends are the same. All of these seek to "Prove all things — to hold fast to that which is good."

Condensation of an address presented April, 1957 at Memphis State University, while Dr. Boell was serving as an AIBS Visiting Lecturer.

Across the Editor's Desk

• ***In the November issue of the AIBS BULLETIN,*** in an editorial footnote to the article "Scientific Manpower in Russia" by W. O. Fenn, a mistake was made. The person who accompanied Dr. Fenn to Russia was **Carl F. Schmidt,** Department of Pharmacology, School of Medicine, University of Pennsylvania, Philadelphia. The person referred to in the footnote was **Karl P. Schmidt** formerly of the Chicago Museum of Natural History, who died September 1957.

• **Eight fellowships in oceanography have been instituted under Unesco's program for 1957-58.** They are intended to further the development of the marine sciences by providing an opportunity for qualified scientists, working or intending to work in marine science research institutions, to carry out specialized studies abroad in any one of the following subjects: physical and chemical oceanography, marine biology, maritime meterology, submarine geology and topography, and also limnology (physico-chemical and biological aspects) when research in this field is calculated to yield results applicable to marine research. The duration of the studies is not to exceed 12 months, in principle. The eight fellowships available will be allotted to candidates presented by Member States of Unesco, after consideration of their qualifications.

• **The fifth Southern Regional Graduate Summer Session in Statistics will be held June 16 - July 26, 1958, at Oklahoma State University, Stillwater, Oklahoma.** The summer sessions are rotated annually among the following institutions: Virginia Polytechnic Institute, Oklahoma State University, University of Florida and North Carolina State College. The program may be entered at any session and consecutive courses will be offered in successive summers. The summer work in statistics may be applied towards residence requirements at any one of the cooperating institutions, as well as certain other institutions, in partial fulfillment of residence requirements for graduate degrees. Each annual summer session lasts six weeks and the several courses offered carry three semester hours of graduate credit.

The sessions are of particular interest to (1) research and professional workers who want intensive instruction in basic statistical concepts and who wish to learn modern statistical methodology, (2) teachers of elementary statistics courses who want some formal training in modern statistics, (3) prospective candidates for graduate degrees in statistics, (4) graduate students in other fields who desire supporting work in statistics, and (5) professional statisticians who wish to keep informed of advanced specialized theory and methods.

The faculty for the 1958 Summer Session at Oklahoma State University will include the following visiting professors: H. O. Hartley, Statistical Laboratory, Iowa State College; Walter T. Federer, Biometrics Unit, Cornell University; John E. Freund, Department of Mathematics, Arizona State College; A. W. Wortham, Operations Research Department, Texas Instruments, Dallas, Texas. The local staff includes: Carl E. Marshall, Franklin Graybill, Robert D. Morrison, John Hamblen, Roy Deal and John Hoffman.

Of particular interest at the 1958 session will be the six weekly symposia covering: Sampling Survey Designs, Experimental Designs, Non-parametric Statistics, Response Curves and Surfaces, Multiple Comparisons, and High Speed Computing. Discussants will be selected from major contributors to these areas. These invited speakers, together with the outstanding summer school staff, will cover the respective subjects from three points of view: applications, their mathematical bases, and the problems that lie on the frontier.

Inquiries should be addressed to Carl E. Marshall, Director, Statistical Laboratory, Oklahoma State University, Stillwater, Oklahoma.

• **The Smith, Kline and French Foundation,** independent philanthropic arm of Smith, Kline and French Laboratories, has recently reported the disbursement of $1,457,876 in the first four years—1953 through 1956—of its history. Basic research in medicine and related sciences received the largest portion of funds — $673,910 for projects unrelated to the Philadelphia pharmaceutical firm's commercial research interests. Next in order were educational grants, $320,711; public charities and community improvement, $178,650; mental health, $157,500; and building and equipment funds, $127,105.

• **The Board of Directors of the André Dreyfus Foundation invite interested persons to apply for the International Genetics Prize for 1958.** The prize is open to individual scientists or groups of research workers from any country, working on problems of genetics or related fields. It may be used for the development of research programs, travel for purposes of research or the publication of the results in research or of monographic summaries. The prize is worth one hundred and fifty thousand Cruzeiros. Applications should be accompanied by the candidates curriculum vitae, list of publications and a detailed plan of the proposed research program, or a copy of the manuscript for publication. In the case of team research the application should be signed by one of the participants. In a case of equality of qualifications preference will be given to the project which may have more direct influence on the development of genetical research in Brazil. Applications accompanied by supporting documents should be received by the Secretary General of the Foundation not later than January 31, 1958. Jenny Dreyfus, Secretária Geral da Fundacão-Prêmio André Dreyfus, Rua Belfort Roxo 40, apto. 502 — Copacabana, Rio de Janeiro, D. F., Brasil.

• **Research Corporation, a non-profit organization, has announced the award, during the third quarter of 1957, of $305,344** to scientists in colleges and universities in this country and abroad as grants-in-aid for basic research. This brings the total for 1957 to $492,-702. Since its foundation, Research Corporation has distributed approximately $11,500,000 to scientists for basic research.

• **The International Union for Conservation of Nature and Natural Resources will hold its sixth General Assembly and seventh Technical Meeting in Athens — Delphi, Greece, September 11-19, 1958.** His Majesty, the King of the Hellenes, has graciously agreed to open the session of the General Assembly. Following the Conference, excursions to various parts of Greece are planned. Requests for accommodations should be made at the beginning of 1958. Applications must be sent before May 31, 1958. All inquiries should be addressed to Secretary General, International Union for Conservation of Nature and Natural Resources, 31, rue Vautier, Brussels, Belgium.

• **The National Science Foundation has released a report on Federal research and development budget.** According to the report, $3 billion was spent for scientific research and development during fiscal year 1957. This represents an increase of almost 20 percent over the 1956 expenditure of $2.5 billion. The Department of Defense and the Atomic Energy Commission accounted for 85 percent of the total funds. Six other agencies—Department of Health, Education and Welfare, Department of Agriculture, National Advisory Committee for Aeronautics, Department of the Interior, National Science Foundation and Department of Commerce—were responsible for all but 1 percent of the remaining budget. More than 60 cents of every dollar was obligated for development; less than 40 cents for research, both applied and basic. Basic research accounted for only 8 cents. The physical sciences, including engineering, claimed 67 percent of the budget; the life sciences, 29 percent; and the social sciences, 4 percent. Thirty-five cents of every dollar went to profit organizations, 14 cents to educational institutions, 48 cents within the Federal Government and 3 cents to "other" institutions. Copies of

Federal Funds for Science VI may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for 35 cents.

• **Agricultural Experiment Stations expenditures for research increased tenfold from 1920 when $7 million was spent to 1953-54 when $74 million was budgeted.** Research funds for these stations came, for the most part, from the State governments and supplemented the core of support provided by the Federal Government. The 53 stations, practically all administered by the land-grant colleges and universities, devoted the largest amount to the areas of animal production and field crops; the smallest, to genetics and farm forestry. This information is contained in a report "Funds for Research in Agricultural Experiment Stations, 1953-54", released by the National Science Foundation. Copies of the report may be obtained by writing to the National Science Foundation, Washington 25, D. C.

• **Research grants totaling $46,031,816 were awarded during the first four months of the current fiscal year by the National Institutes of Health,** the Public Health Service's research center at Bethesda, Maryland. 3,325 grants were made to non-Federal scientists and institutions throughout the Nation. Of these grants 1,085 were awarded for new projects. The grants supported research projects in 478 institutions—medical schools, universities, hospitals, and other research centers — in 48 states, the District of Columbia, 2 Territories, and 18 foreign countries.

• **The National Science Foundation has made available funds for the establishment of Awards for research and study at the Mountain Lake Biological Station from June 12 to August 20, 1958.** Three types of awards are available: Post-Doctorates for research; Pre-Doctorates for supervised research; and Post-Graduates for training in field or laboratory research techniques, thus permitting course work. Application blanks for these awards may be secured from Horton H. Hobbs, Jr., Department of Biology, University of Virginia, Charlottesville, Va., and must be submitted by April 1, 1958.

• **The Robert A. Taft Sanitary Engineering Center in Cincinnati is offering eleven training courses in radiological health, air pollution, water pollution and food sanitation during January, February and March, 1958.** Courses offered are: Basic Radiological Health, Environmental Health Aspects of Nuclear Reactor Operations, Detection and Control of Radioactive Pollutants in Air, Detection and Control of Radioactive Pollutants in Water, Sanitary Engineering Aspects of Nuclear Energy, Atmospheric Sample Analysis, Air Pollution Effects on Vegetation, Micro-biological and Chemical Examination of Milk and Dairy Products, Laboratory Methods for Prevention and Control of Food-Borne Disease, New Techniques in the Bacteriological Examination of Water, and Advanced Training for Sanitary Engineers in Water Supply and Water Pollution. Admission to qualified individuals to all courses is governed largely by priority of applications. No tuition fee is charged. Applications should be sent to Chief, Training, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio.

• **The Office of Naval Research,** during the first six months of fiscal year 1958 (July 1, 1957 - December 31, 1957) awarded a total of 122 research contracts. Of these, 30 supported work in physiology, 15 in biochemistry, 25 in microbiology, 28 in medicine and dentistry, and 4 in biology.

• **The Marine Institute of the University of Georgia has announced a *Conference on Salt Marshes* to be held at Sapelo Island, Georgia, March 25-28, 1958.** The conference is being sponsored jointly by the National Science Foundation and the Marine Institute. It will be international in character. Its purpose is to bring together scientists who are working on, or interested in, salt marshes for discussion of research on this particular environment. An invited group of about 25 people will participate in the conference; invitations will be extended on request to a limited additional number of persons who wish to attend at their own expense. The conference is under the direction of Alfred C. Redfield of Woods Hole, Mass. Interested people should contact: Robert A. Ragotzkie, University of Georgia Marine Institute, Sapelo Island, Georgia.

• **The Biology Department of Southwestern Louisiana Institute** now occupies a new million dollar building, which includes a green house, live animal room and museum. It also provides office facilities for John J. Lynch and Van T. Harris of the U. S. Fish and Wildlife Service.

• **A committee of the faculty of the Department of Biology, University of Notre Dame,** will edit *The American Midland Naturalist*. George R. Bernard has been appointed chairman of the Editorial Committee.

• **The Biological Laboratory at Cold Spring Harbor, New York,** will offer three specialized courses during the summer of 1958. These are designed to acquaint research workers with the most important techniques used in bacterial virus research, bacterial genetics research, and quantitative studies of human cells in tissue cultures. The course in Bacterial Viruses, to be given by F. W. Stahl and S. E. Luria, is scheduled for three weeks beginning June 16; the Bacterial Genetics course will be given by M. Demerec, Evelyn Witkin, V. Bryson and P. E. Hartman, for three weeks beginning July 7; and the course in Quantitative Study of Human Cells in Tissue Cultures, to be given by H. Moser and E. H. Y. Chu, is scheduled for three weeks beginning July 28. Applications should be made to: Director, Biological Laboratory, Long Island Biological Association, Cold Spring Harbor, New York.

• **An advanced Science Writing Program, financed by a pilot grant of $70,000 from the Alfred P. Sloan Foundation, has been established at Columbia University's Graduate School of Journalism.** Under the program, selected young reporters and writers will be invited to spend an academic year at the University on fellowships that cover their class, tutorial and seminar costs, plus approximately $550 a month for living expenses. It is expected that most fellowship recipients will be individuals with some scientific interest, plus three to six years experience on newspapers, magazines, wire services or radio-television. Under the initial grant four or five full fellowships a year will be granted, but it is hoped that the program may be expanded to provide for ten fellows a year. The advance program will have an Advisory Board, consisting of representatives of Columbia's faculties of Pure Science, Medicine and Engineering, the National Association of Science Writers, and research scientists from private organizations.

• **A Summer Workshop on *Classical Physiology with Modern Instrumentation* will be given at Baylor University College of Medicine, Texas Medical Center, Houston, Texas, July 9-18, 1958.** The course, to be given in Baylor's new Laboratory of Physiology is open to the following candidates: teachers of Biology and Physiology in undergraduate colleges and universities, teachers of Physiology and Pharmacology in medical schools, medical graduates desiring an introduction to reasearch in Physiology and Pharmacology, physiologists and pharmacologists in Government and industrial establishments requiring training in experimental physiology, graduate students in Physiology and Pharmacology, and se-

lected candidates from the Physical Sciences who are concerned with biological problems. A fee of $150 will cover all expenses of the course. A limited number of fellowships covering tuition and other expenses will be available. Applications will be accepted immediately and should contain information on candidate's training, degrees, positions held, etc. Deadline for applications is March 31, 1958.

• **Oregon State College will sponsor a colloquium in early April on the subject of Photobiology.** F. W. Went, California Institute of Technology, will be chairman. The program is designed to be of interest to biologists in general, especially those in physiology and related fields. The colloquium is open to the public. Further information, including the dates, may be obtained by communicating with R. W. Newburgh, Science Research Institute, Oregon State College, Corvallis, Oregon.

• **A Summer Laboratory Course in Techniques and Applications of the Electron Microscope will be held again at Cornell University from June 16-July 3, 1958.** The course will include lectures covering the basic principles, methods and applications of the electron microscope. Laboratory work will offer the opportunity for instruction and practice in a wide range of techniques, especially applicable to biological studies. The program is primarily for scientists using the electron microscope in their research work. The course is under the direction of Benjamin M. Siegel, who will be assisted in the lectures, discussions and demonstrations by a number of workers prominent in biological research applications of the electron microscope. Registration for the course is limited. Applications should be made promptly to: Benjamin M. Siegel, Rockefeller Hall, Cornell University, Ithaca, New York.

• **The Institute of Marine Science, University of Texas, recently established a marine microbiology section under the direction of Carl H. Oppenheimer.** The Institute is located on Mustang Island at Port Aransas, Texas, approximately 25 miles north of Corpus Christi. The laboratory has been established to provide facilities to study the relationships of bacteria to the many environments near the Institute. Close at hand are attached algal flats, muddy bottom bays, accumulations of organic matter, oyster reefs, continental shelf environments, rock jetties, open beaches and various sources of industrial and sewage pollution. A course in marine microbial ecology will be offered during the summer. A curriculum has been established for advanced degrees with emphasis on marine bacteriology through the Department of Bacteriology, University of Texas, Austin, Texas.

• **The American Horticultural Council has announced the availability of the Nickerson Color Fan,** a new color chart for horticulturalists and botanists. The Fan, approved by America's outstanding color foundation, folds into a booklet 7½ inches by 1¾ inches, which fits easily into a pocket or handbag. It contains 262 colors of 40 hues. It is available at $5.00 postpaid, from the Secretary's Office, American Horticultural Council, Arnold Arboretum, Jamaica Plain 30, Mass. Included with the color chart is a 12-page booklet explaining the use of the fan in detail. Printed in small type on each color is the popular color name and its numerical designation in the Munsell color system, which is fast becoming accepted as standard by many industries and societies dealing with color systems in America. The chart uses color names that have been selected as standard by the Inter-Society Color Council and the National Bureau of Standards.

• **The Fourth Annual Symposium on Systematics, sponsored by the Missouri Botanical Garden, was held October 25-26, 1957.** The meeting was under the joint chairmanship of Carl Epling and Ernst Mayr. The subject of the symposium was "Basic concepts and techniques in systematics". Five invited papers were given by Warren H. Wagner, University of Michigan; Charles D. Michener, University of Kansas; Harrison D. Stalker, Washintgon University; Richard W. Pohl, Iowa State University and Robert F. Inger, Chicago Natural History Museum. Devoted to the systematics of zoology as well as of botany, these symposia are attended by scientists and their students from universities and colleges throughout the central part of the United States. As in the past, this symposium was supported in part by a grant from the National Science Foundation.

• **The Illinois State Academy of Sciences will hold its fifty-first annual meeting on the University of Illinois campus, Urbana, May 8-10, 1958.** A feature of the meeting will be observance of the hundredth anniversary of the founding of the Illinois Natural History Survey, which is located on the campus.

• **Duke University School of Medicine and Duke Hospital is offering a course in Medical Mycology July 1-26, 1958.** Instruction by members of the departments of medicine, pathology and bacteriology will emphasize the clinical, pathological and therapeutic aspects of fungus infections. Patients, clinical materials, cultures and laboratory animals will be available for study. An opportunity to study pathological materials, gross and microscopic, will be given those whose interest and previous training would make this of value to them. The practical laboratory aids which help to establish a definitive diagnosis will be stressed. The course is open to clinicians, pathologists, bacteriologists, technicians and others who have an interest in the medical phases of Mycology. Classes meet six days a week. Inquiries concerning this course should be directed to: Norman F. Conant, Duke Hospital, Durham, North Carolina.

• **The Botany and Zoology Departments of the University of Wisconsin have expanded their physical facilities for the first time in 45 years.** They have now moved into a new $1,850,000 addition to Birge Hall, which was built in 1912. The new wing doubles the physical facilities of the two departments.

• **West Virginia University** has joined the Oak Ridge Institute of Nuclear studies bringing the total number of sponsors of ORINS to 36.

• **Rockefeller Foundation granted, during the third quarter of 1957, $1,890,525.** Grants in the field of medical education and public health amounted to $304,915; biological and medical research, $350,650; agriculture, $384,240; social sciences, $186,415; humanities, $251,105. General appropriations totaled $413,200. During the same period 123 fellowships were awarded to individuals from 30 countries.

• **The Ford Foundation recently announced grants and appropriations totaling $49,187,371 in the final quarter of 1957.** Of this amount $24.5 million was granted to the Woodrow Wilson Fellowship program to attract outstanding college students to college teaching careers.

• **Frank Brink, Jr.,** has been appointed to the newly created office, Dean of Graduate Studies, at the Rockefeller Institute for Medical Research. The function of the Dean will be to assist the President and the Faculty Committee on Educational Policies in the development of graduate education in the Institute; to organize the programs of lectures, seminars and laboratory instruction; to counsel with graduate students and their faculty advisors.

• **Charles E. Raven,** personal chaplain to Queen Elizabeth of England, and recent vice-chancellor of Cambridge Uni-

versity, has accepted an appointment as the University of Cincinnati College of Medicine's first visiting professor of the philosophy of science.

• **William F. Windle,** Chief, Laboratory of Neuroanatomical Sciences, National Institutes of Health has been awarded the Max Weinstein Award at the eighth annual convention of the United Cerebral Palsy Association in St. Louis, Mo. The award, which consists of a silver plaque and $1,000, is made annually for outstanding achievements in basic research related to cerebral palsy.

• **Paul P. Weinstein,** of the Laboratory of Tropical Disease, National Institutes of Health, has been awarded the Bailey K. Ashford award of the American Society of Tropical Medicine and Hygiene. The award, which consists of a gold medal and an honorarium of $1,000, is given annually to a young scientist for outstanding research in the field of tropical diseases.

• **Burton W. Adkinson** has been appointed Head of the Office of Scientific Information of the National Science Foundation. Dr. Adkinson has been Director of the Reference Department of the Library of Congress since 1949.

• **Robert W. Wissler** has been named chairman of the Department of Pathology at the University of Chicago. He succeeds **Paul R. Cannon,** who retired September, 1957, after 17 years as chairman and 32 years on the medical faculty. Dr. Cannon will continue as chief editor of *Archives of Pathology* of the American Medical Association and will maintain an office on the campus as professor emeritus.

• **Harold St. John,** first holder of the Wilder Chair in Botany at the University of Hawaii, has been elected an Honorary Member of the Botanical Society of Japan. Election to the honor was conferred at the Diamond Jubilee celebration of the society in Tokyo, during October, 1957.

• **John T. Bonner,** Princeton University, has been appointed Advisory Editor in the field of Biology to Dodd, Mead and Company, publishers.

• **William C. Steere,** Dean of the Graduate Division of Stanford University, has been appointed Director of the New York Botanical Gardens, effective July, 1958. In the interim **David D. Keck,** Assistant Director and Head Curator, will serve as Acting Director. **William J. Robbins,** the present Director, retired December 31, 1957, at his own request.

• **Clark T. Rogerson,** assistant professor of Botany at Kansas State College and assistant mycologist at the Agricultural Experiment Station, has been appointed Curator of the Cryptogamic Herbarium of the New York Botanical Garden, effective February 1, 1958.

• **James B. Ross** has been appointed Manager of the newly established College Department of the Reinhold Publishing Corporation. The College Department will publish undergraduate and graduate textbooks to serve the teaching needs in the physical and biological sciences, engineering and related disciplines.

• **Olive R. Hester,** who held the Edwin Louis Stevens Honor Professorship in Science at Southwestern Louisiana Institute, retired from active teaching in June, 1957.

• **Carrol R. Norden** and **William D. Reese** have been appointed assistant professors of Zoology at Southwestern Louisiana Institute.

• **George H. Bick,** associate professor of Biology, Southwestern Louisiana Institute, has been elected to the Board of Governors of the Southwestern Association of Naturalists.

• **Richard R. Kudo,** Emeritus Professor of Zoology at the University of Illinois, is currently visiting professor of protozoology at the Institute of Microbiology, Rutgers University. Dr. Kudo will remain at the Institute until the end of the current academic year.

• **Albert R. Mead,** for the past year acting head of the department of zoology, University of Arizona, has been appointed head of the department.

• **Hugo L. Blomquist,** member of the Botany Department, Duke University, since 1920 and chairman from 1930 to 1954, has retired.

• **Robert L. Wilbur,** formerly of the North Carolina State College, has been named Taxonomist and Curator of the Vascular Herbarium, Duke University.

• **Robert H. Wasserman,** bacteriologist and animal nutritionist, has resigned as Senior Scientist, Medical Division, Oak Ridge Institute of Nuclear Studies, to accept the post of Research Associate, Cornell University.

• **Giuseppe Bertani,** for the past three years senior research fellow in biology, geneticist at the California Institute of Technology, has been appointed associate professor of medical microbiology at the University of Southern California.

• **James M. Price,** University of Wisconsin Medical School, and **Seymour Cohen,** University of Pennsylvania, have been named the first recipients of the American Cancer Society's new life-time salary grants. These awards for two permanent faculty level positions in cancer research amount to $224,000 for the University of Pennsylvania and $392,296 for the University of Wisconsin.

• **Carl Lamanna,** has been appointed scientific director of the Naval Biological Laboratory and affiliated Naval Medical Research Unit No. 1 at the University of California in Berkeley. Dr. Lamanna was formerly with the School of Hygiene and Public Health at Johns Hopkins University.

• **George R. Johnson,** associate professor of animal science, Ohio State University, has been promoted to professor and chairman of the Department, effective January 1, 1958. He will also serve as chairman of animal science at the Agricultural Experiment Station. **Laurence A. Kauffman,** whom Dr. Johnson succeeds, has been chairman since 1955 and asked to be relieved of administrative duties.

• **Clarence F. Winchester,** animal physiologist, U. S. Department of Agriculture, Agricultural Research Center, Beltsville, Maryland, has accepted a two year appointment by the International Cooperation Administration as livestock advisor to the Government of Ceylon. Dr. Winchester will be stationed at Ceylon University, Peradeniya.

• **Edwin Diamond,** Science writer for International News Service, has been named Science Editor of *Newsweek*.

• **Garth J. Thomas,** has been appointed research professor in the Bioacoustics Laboratory and the Department of Physiology, University of Illinois.

• **M. G. Candau,** Director-General of the World Health Organization, has accepted an appointment to head WHO for a second term.

• **Among the emeriti professors who are currently engaged in a year of teaching in independent liberal arts colleges under the Whitney Visiting Professors Program, is Harvey Stork,** professor of botany, Carleton College, Northfield, Minnesota. Dr. Stork is presently at Tougaloo Southern Christian College, Tougaloo, Mississippi. The Whitney Visiting Professors Program was established in 1952 to (a) honor individuals who have not only distinquished themselves by a life-time of classroom teaching, but who have also retained the physical and mental vigor to continue making contributions and (b) to strengthen teaching independent liberal arts colleges throughout the country.

• **George S. Avery, Jr.,** Director of the Brooklyn Botanic Gardens, has received the Distinguished Service to Brooklyn Award, which is presented annually by the Library Associates of Brooklyn College.

• **George W. Hunter, III,** who retired from the Army in 1955 as colonel, has been appointed lecturer in biological sciences and medicine at the University of

Florida. Dr. Hunter is teaching medical parasitology in the department of microbiology at the medical school.

• **Ntinos C. Myrianthopoulos,** who has been conducting research in human genetics at the Dight Institute of Human Genetics at the University of Minnesota, has joined the epidemiology branch of the National Institute of Neurological Diseases and Blindness.

• **James H. M. Henderson** has been appointed head of the Department of Biology, Tuskegee Institute. The Institute is now offering a major in biology. Dr. Henderson has been professor of biology in the School of Agriculture. He will also continue as research associate at the Carver Foundation.

• **L. J. Audus,** professor of botany and head of the Botany Department at Bedford College, University of London, will be visiting Professor of Botany in the Department of Botany, University of California at Berkeley, for the Spring semester, 1958, where he will present a lecture and laboratory course on the physiology of plant growth and development.

• **Fred B. Hutt,** Cornell University, delivered the George Scott Robertson Memorial Lecture at Queen's University of Belfast, September 27, 1957. Dr. Hutt's address was "Prospects and Procedures for Breeding Better Poultry."

Recent deaths among biologists:

Walter H. Schaefer, Marquette, Michigan; professor of biology at Northern Michigan College since 1946. 55; Sept. 1957.

Arlow B. Stout, Pleasantville, N. Y.; curator emeritus of the New York Botanical Garden. 81; Oct. 1957.

Alphaus Blizzard, Hartsville, S. C.; biologists and retired member of the staff of the plant quarantine section of the USDA. Oct. 1957.

Gerty T. Cori, St. Louis, Mo.; professor of biological chemistry at Washington University. 61; Oct. 1957.

Herbert F. Gerald, Lake Zurich, Ill.; professor emeritus of physiology and pharmacology at Creighton University and former chairman of the department. 76; Oct. 1957.

Edward J. Keegan, Floral Park, N. Y.; chairman of the biology department at St. John's University. 56; Nov. 1957.

George W. Merck, West Orange, N. J.; chairman of Merck & Co., Inc. and former chairman of the United States Biological Warfare Committee. 63; Nov. 1957.

Joseph A. Stephan, Cincinnati, Ohio; general superintendent of the Cincinnati zoo from 1937 to 1949; past president of the American Association of Zoological Parks. 77; Nov. 1957.

Dwight F. Barnes, Fresno, California; economic entomologist and specialist in dried-fruit insects for the USDA. 67; Oct. 1957.

John W. Roberts, Winter Park, Florida; plant pathologist, and specialist in fungicides. 75; Nov. 1957.

Druska Schaible, Fairbanks, Alaska; professor of biological sciences at University of Alaska. 46; Nov. 1957.

Abby Howe Turner, South Hadley, Mass.; professor emeritus and first chairman of the physiology department of Mount Holyoke College. 82; Nov. 1957.

Delmar Young, Port Washington, N. Y.; professor of dairying at the University of Delaware. 48; Nov. 1957.

From the Societies

• The Committee on the Darbaker Prize of the **Botanical Society of America** will accept nominations for an award to be announced at the annual meeting of the Society in 1958. Under the terms of the bequest, the award is to be made for meritorious work in the study of the algae. Persons not members of the Botanical Society are eligible for the award. The Committee will base its judgement primarily on the papers published by the nominee during the last two full calendar years previous to the closing date for nominations. At present, the award will be limited to residents of North America. Only papers published in the English language will be considered. The value of the Prize for 1958 will depend on the income from the trust fund but is expected to be about $150.00. Nominations for the 1958 award accompanied by a statement of the merits of the case and by reprints of the publications supporting the candidacy should be sent to the Chairman of the Committee in order to be received by May 1, 1958. The Committee Chairman is George F. Papenfuss, University of California, Berkeley, California.

• During the annual meeting of the **Society of American Foresters** at Syracuse, New York, November, 1957, two awards were made for oustanding achievement in biological research contributing to the advancement of forestry. Each award consisted of an engraved plaque and a cash payment. One recipient was **Harold J. Lutz** of New Haven, Connecticut, Professor of Silviculture on the faculty of the Yale University School of Forestry. **C. Syrach Larsen** of Denmark, head of the Danish National Arboretum, received the other award. In Dr. Larsen's absence his award was made to his friend and Colleague Erik Holmsgaard, director of the Danish Forest Experiment Station.

• The **National Science Teachers Association** elected the following officers for 1957-58: President: Glenn O. Blough; President-elect: Herbert A. Smith; Treasurer: Robert T. Lagemann; Secretary: H. M. Louderback, Lewis and Clark High School, Spokane, Washington.

The sixth national meeting of the **National Science Teachers Association** will be held at Denver, Colorado, March 27-29, 1958. Information about the program and meeting site may be obtained from R. H. Carleton, National Science Teachers Association, 1201 16th St., N.W., Washington 6, D. C.

• 1957-58 officers of the **Mycological Society of America** are: President: John Raper; President-elect: C. J. Alexopoulos; Vice-president: C. W. Emmons; Secretary-Treasurer: E. S. Beneke, Michigan State University, East Lansing, Mich. Councilors are: (East) C. W. Emmons and C. W. Hesseltine; (West) Ralph Emerson and Helen M. Gilkey.

• The fifth annual meeting of the **Southwestern Association of Naturalists** will convene in Nacogodoches, Texas, April 11-13, 1958, with headquarters at Stephen F. Austin State College. One day of the meeting will be devoted to the presentation of papers and two days to field work. Further information may be obtained from R. W. Strandtmann, Department of Biology, Texas Technological College, Lubbock, Texas.

• The 1958 annual meeting of the **International Association for Dental Research** will be held March 20-23 at the Statler Hotel in Detroit, Michigan.

• The **American Society of Plant Physiologists** elected the following officers for 1958: President: David R. Goddard; Vice-president: Arthur W. Galston; Executive Secretary-Treasurer: G. Ray Noggle, University of Florida, Gainesville, Florida and Secretary: Walter D. Bonner, Jr., Cornell University, Ithaca, N. Y.

• The **American Society of Tropical Medicine and Hygiene** elected the following officers: President: Donald L. Augustine; President-elect: Lewis W. Hackett; Vice-president: Paul C. Beaver; Secretary-Treasurer: Rolla B. Hill, Miami, Florida; Editor: Martin Frobisher.

• The **National Shellfisheries Association** elected the following officers for 1958: President: Melbourne R. Carriker; Vice-president: L. Eugene Cronin; Secretary-Treasurer: Philip A. Butler, U. S. Fish and Wildlife Service, Gulf Breeze, Florida.

• **National Wildlife Federation** will meet in St. Louis, Missouri, March 1-3, 1958. For further information please contact: E. F. Swift, National Wildlife Federation, 232 Carroll St., N.W., Washington 12, D. C.

At the same time the annual meeting of the **Wildlife Society** will be held. For information concerning the program of

this organization contact: D. L. Leedy, U. S. Fish and Wildlife Service, Washington 25, D. C.

• **American Association of Anatomists** will hold its annual 1958 meeting at Buffalo, N. Y. L. B. Flexner, Department of Anatomy, School of Medicine, University of Pennsylvania, Philadelphia 4, Pennsylvania, may be reached for further information.

• The **American Society of Zoologists** announces a Summer Institute on Developmental Biology, Cytogenetics, and Evolution, to be held at Williams College, Williamstown, Massachusetts, from June 30-August 8, 1958. The Institute, which will be open to college teachers only, is intended to enable teachers of the biological sciences, particularly in the smaller colleges, to study recent advances in important areas of current research interest. A program of lectures, laboratory work, and discussions will be conducted by well-known specialists in the various fields to be covered. Under a grant from the National Science Foundation participants will receive stipends of $450 for the session, plus dependency and travel allowances. Further information and application forms may be obtained from the Director of the Department of Biology, Williams College, Williamstown, Mass.

A.I.B.S. Reports

• **The AIBS Advisory Committee on Microbiology to the Office of Naval Research** met at the Lerner Marine Laboratory, Bimini, B. W. I., December 2-4, 1957. Nine proposals were evaluated. The Committee spent some time discussing the future development of the Laboratory and its role in the Caribbean area. Roger Porter is Chairman of this Committee.

• **On December 12-13, 1957 the AIBS Advisory Committee on Hydrobiology to the Atomic Energy Commission** met in Washington, D. C. at the AIBS Conference Room. The Committee advised AEC on research projects in the field and various aspects of its hydrobiological program.

• **The Policy Committee of the American Society of Zoologists** met in Washington, D. C. in the AIBS Conference Room, December 13-14, 1957.

• **The AIBS *ad hoc* Advisory Committee on the Maintenance of Genetic Stocks to the National Science Foundation** met in Washington, D. C., December 12-13, 1957. Chairman of this Committee is Bentley Glass.

• **On January 8-10, 1958, the AIBS Advisory Committee in Education and Training to AEC** met at Oak Ridge and Gatlinburg, Tenn. Thirty-two proposals were evaluated. J. Newell Stannard is Chairman of this Committee.

• **The Selection Committee, appointed by various zoological societies, to review applications for NSF Travel Grants to the XVth International Zoological Congress,** met in Chicago, January 24-25, 1958. Eighty-seven applications were received by AIBS, which is administering the Committee and the Grants.

• **On February 8, 1958, the Selection Committee appointed by Microbiological Societies to review applications for NSF for Travel Grants to the VII International Microbiology Congress** met in Philadelphia. One hundred and twenty-five applications were received prior to the closing date. Announcements will be made by March 1st.

• **The AIBS Advisory Committee on Biology to ONR** will meet in Washington, D. C., February 13-14, 1958 to evaluate 14 proposals. Frank Brown, Jr., is chairman of this Committee.

• **The January 1958 AIBS Placement Service Directory,** containing information about approximately 125 highly specialized biologists, will be available for distribution in February. Cost per copy is $1.00 and any prospective employer of biologists may subscribe to the Directory. That the Placement Service may render better service to both biologists seeking employment and employers seeking biologists, the Director would appreciate receiving specifications of current or prospective vacancies so they may be registered in the AIBS office.

• **The AIBS Speakers Bureau** has received funds from the National Science Foundation to continue and extend the program for academic year 1957-58. Twenty-two outstanding biologists representing most fields of the life sciences, have volunteered to participate in the program. Over 30 institutions have requested speakers or made inquiries concerning the possibility of obtaining lecturers. Each scientist will spend from three to five days on a campus. During that time he will be available for seminars, classroom lectures, biology and science study groups, convocation or chapel exercises, and will meet informally with students and faculty. Speakers will also make themselves available to other colleges in the vicinity, and to high schools or civic organizations if their services will further the activities of the group concerned.

Speakers participating during the 1957-58 academic year are: *Daniel I. Arnon*, Plant Physiology; *Dietrich Bodenstein*, Zoology; *E. J. Boell*, Zoology; *Lawrence Bogorad*, Plant Physiology; *Victor R. Boswell*, Horticulture; *Frank A. Brown, Jr.*, Zoology; *Theodore H. Bullock*, Zoology; *Barry Commoner*, Cellular Physiology; *Harry J. Fuller*, Plant Physiology; *Arthur W. Galston*, Plant Physiology; *Nash Herndon*, Medical Genetics; *W. D. McElroy*, Biology, Biochemistry; *George L. McNew*, Botany, Plant Physiology; *Howard T. Odum*, Limnology, Oceanography; *Robert C. Murphy*, Zoology, Ornithology; *Loren C. Petry*, Botany; *Ernest C. Pollard*, Biophysics; *Kenneth D. Roeder*, Biology; *S. R. M. Reynolds*, Physiology; *Karl Sax*, Botany; *Laurence H. Snyder*, Zoology; and *Talbot H. Waterman*, Zoology.

In conjunction with the AIBS Speakers Bureau, the Atomic Energy Commission has entered into a contract to supplement the program with biologists currently employed in AEC laboratories. This part of the Program was initiated in February 1957 and 43 biologists have volunteered to participate. They are drawn from the following installations: Argonne Cancer Research Hospital; Argonne National Laboratory; Brookhaven National Laboratory Medical Department; Atomic Energy Project, University of Rochester; Donner Laboratory, University of California; UCLA Atomic Energy Project; Hanford Atomic Products Operation, Richland, Washington; Oak Ridge National Laboratory Union Carbide Nuclear Company; Oak Ridge National Laboratory Health and Physics Division; Oak Ridge Institute of Nuclear Studies Medical Division; University of Washington Applied Fisheries Laboratory; and Western Reserve University Atomic Energy Medical Research Project.

The Commission is interested in bringing information concerning radiation biology and the use of isotopes as research tools to the attention of scientists in all disciplines. The AEC lecturers will be scheduled *within the states bounding their home states.*

All applications for assignments of speakers should be addressed to: Speakers Bureau, American Institute of Biological Sciences, 2000 P St., N.W., Washington 6, D. C.

• **The Governing Board of the Entomological Society of America,** during the annual meeting at Memphis, Tenn., December 5, 1957, voted to recommend to the membership of the Society, full Membership in AIBS, effective January 1, 1959.

• **The Education and Professional Recruitment Committee** of AIBS met in Indianapolis, December 29, 1957. Oswald Tippo is Chairman of this Committee. Actions and recommendations of the Committee will be reported in a later issue of the *Bulletin*.

• **The AIBS Life Plan,** which offered reasonable group life insurance to younger biologists, has been discontinued, due to insufficient applications.

• **Several persons have suggested that an Art Show** be held in conjunction with the annual AIBS meetings. The many biologists who paint or sculpture might appreciate the opportunity of showing their work to an interested group—particularly if the work involved biological subjects. The AIBS cannot assume responsibility for works of arts shown or cover the show with insurance. Transportation costs to and from the convention site will have to be assumed by the artist. However, attractive salon space can be made available at Indiana University if sufficient interest is shown. That the Convention Director may know whether such a Show would be of sufficient interest, all persons who wish to submit paintings, sketches, or sculpture, are asked to send their names and ideas to the AIBS office.

Education and Manpower

• **Over 600,000 books have been sent to more than 1,200 universities, colleges, libraries, and civic groups in Asia during the past two and one-half years via the Asian Foundation's special project Books for Asian Students.** These books were donated by seven hundred universities and college groups, publishers and libraries and individuals in the United States. The Asian Foundation is a nonprofit, non-political organization founded by private American citizens, supporting individuals and groups in Asia who are working for "attainment of peace, independence, personal liberty and social progress". The Foundation maintains 18 offices in Asia.

The need for books continues, as evidenced by increasing requests. Contributions of books will be greatly appreciated. Items in every category of the university and college level, in good condition, published by 1948 or later, as well as works by standard authors regardless of date can be sent directly to: Books for Asian Students, 21 Drumm St., San Francisco 11, California. The Foundation will reimburse donors for the transportation cost of substantial shipments to San Francisco. All contributions are tax exempt.

• **A new type of written science test is being devised by the College Entrance Examination Board** to find true potential scientists as opposed to "gadgeteers". Plans for the tests were described at a recent conference of the New York Association of Biology Teachers.

• **The National Education Association recently released results of a study on the change in the amount of preparation of college teaching staffs,** with science one of the major areas affected. Fewer and fewer of the recent graduates holding Ph.D.'s have been joining teaching ranks in colleges and universities during the past four years. During the past year (1956-57) only 23.5 percent of all new full-time teachers held a Ph.D. degree. Four years ago 31.4 percent were Ph.D.'s. The production of Ph.D.'s is four times greater than it was ten years ago, but a greater proportion of these new graduates are accepting jobs in business and industry rather than in teaching.

Science teaching is the most affected. Only one out of four new Ph.D.'s in Chemistry turn to employment in the field of education, three out of five new Ph.D.'s in Physics and other physical sciences are accepting positions outside the field of education. The number of new full-time college faculty members without a Master's degree is also increasing. Four years ago this group comprised 18 percent of the total. By 1956-57 the figure had risen to more than 23 percent. Every one of the 22 fields studied, except one, showed an increase in the percentage of new teachers without advanced degrees.

• **In October 1955, a Conference on Improvement of Science Teaching was held, sponsored jointly by the National Science Foundation and the American Association for the Advancement of Science.** This Conference passed a resolution to have an inter-agency News Letter prepared. The first of these appeared in April, 1956, and the fifth was issued November 1, 1957. In the current issue of the News Letter an attempt has been made to report on each participating organization. Special emphasis has been placed on new projects not previously listed and on progress reports. The report is for the most part restricted to the activities of the national professional societies, except in some cases where programs of special importance are involved. Twenty-five separate reports are included. A limited number of single copies are available. Requests should be directed to: Assistant Director of the Science Teaching Improvement Program, J. R. C. Brown, AAAS, 1515 Mass. Ave., N.W., Washington 5, D. C.

• **Approximately 5,000 high school and 250 college teachers of science and mathematics will benefit during the summer of 1958 from teacher-training programs sponsored by the National Science Foundation at 108 Summer Institutes in 104 educational institutions.** Grants totaling $5,340,000 will support the summer institutes. Ninety-nine of the Institutes will be open only to high school teachers of science and mathematics; four will be open to both high school and college teachers; and five to college teachers only. Twelve Institutes offering courses in radiation biology for high school teachers are being jointly sponsored by the Foundation and the Atomic Energy Commission. The Foundation grants to each summer institute will cover costs of tuition and other fees for a specified number of teachers, averaging 50 per Institute. Most Institutes will pay stipends directly to participating teachers at a maximum rate of $75 per week. Additional allowances for dependents to a maximum of four and for travel are provided. Inquiries and applications for participation should be addressed to the Director of the individual institutes named in the following list, which also designates the host institution and eligible teachers.

(RB—Radiation Biology; P—Physics; M—Mathematics; GS—General Science; ES—Earth Science; C—Chemistry; and B—Biology).

Alabama College, (B,C,GS,P), Paul C. Bailey, Biology Department; *Alabama, University of*, (B,C,ES,GS,M,P), Charles K. Arey, College of Education; *Tuskegee Institute (Ala.)*, (C), W. Edward Belton, Chemistry Department; *Alaska, University of*, (B,C,M,P), Alfred M. Bork, Physics Department; *Arizona, University of*, (GS,M), Millard G. Seeley, Chemistry Department; *Arkansas, University of*, (B,C, GS,M,P), Lowell F. Bailey, Botany and Bacteriological Department; *California, University of (Berkeley)*, (B,C,ES,GS,P), Robert A. Rice, University Extension; *California, University of, Medical Center, (Los Angeles)*, (B,C,GS,P,RB) Raymond L. Libby, Radiology Department; **Claremont College (Calif.)*, (B,GS), Willis E. Pequegnat, Zoology Department; *San Jose State College (Calif.)*, (GS), Wilbur Sprain, Natural Science Department; *Southern California, University of*, (C,P), Charles S. Copeland, Chemistry Department; *Colorado College*, (B,C,GS,M,P), Lewis N. Pino, Cutler Hall; *Denver, University of (Colo.)*, (C,P), Byron E. Cohn, Physics Department; *Connecticut, University of*, (P), David J. Blick, Physics Department; *Wesleyan University (Conn.)*, (B,C,ES,GS,M,P), Vincent W. Cochrane, Biology Department; *Delaware, University of*, (B,C,GS,M,P), Cecil C. Lynch, Chemistry Department; *American University (D.C.)*, (C,P), Leo Schubert, Chemistry Department; *Howard University (D.C.)*, (RB), Marie C. Taylor, Botany Department; *Florida State University* (B.C.GS,M,P), J. Paul Reynolds, College of Arts and Sciences; *Atlanta University (Ga.)*, (B,C,M), K. A. Huggins, Chemistry Department; *Georgia, University of*, (B,C,GS,M,P), T. H. Whitehead, Chemistry Department; *Hawaii, University of*, (B,C,GS,M,P), John J. Naughton, Chemistry Department; *Idaho, University of*, (B,C,M,P), W. H. Cone, Physical Sciences Department; *Chicago, University of, (Ill.)*, (M), Alfred L. Putnam, Eckhart Hall 411; **Illinois, University of*, (ES), D. M. Henderson, Geology Department; *Illinois Wesleyan University*, (B,C,M,P), Wayne W. Wantland, Science Division; *Indiana University*, (B), Shelby D. Gerking, Zoology Department; *Notre Dame, University of, (Ind.)*, (M), Arnold E.

Ross, Mathematics Department; *Purdue University (Ind.)*, (B,RB), R. R. Armacost, Biological Sciences Department; *Drake University (Iowa)*, (B,C,GS,P), R. R. Haun, Physical Science Department; *Iowa State College of A &M Arts*, (B,C, GS,M,P), J. A. Greenlee, Science Division; *Iowa State Teachers College*, (GS), Dorothy C. Matala, Biology Department; *Kansas State Teachers College*, (B,C,ES, GS,P), Otto M. Smith, Chemistry Department; **Kansas, University of*, (M), G. Baley Price, Mathematics Department; *Murray State College (Ky.)*, (B,C,ES, GS,P), Alfred M. Wolfson, Biological Sciences Department; *Dillard University (La.)*, (B,C), Edward E. Riley, Jr., Natural Science Division; *Louisiana State University*, (B,C,M,P), H. B. Williams, Chemistry Department; *Bowdoin College, (Me.)*, (P), Noel C. Little, Physics Department; *Colby College, (Me.)*, (B,C,M,P), Evans B. Reid, Chemistry Department; *Maryland, University of*, (B,C,GS,P), Joshua R. C. Brown, Zoology Department; *Morgan State College (Md.)*, (B,C,ES,GS, M,P), Thomas P. Fraser, Science Education Department; **Harvard University (Mass.)*, (RB), A. K. Solomon, Harvard Medical School; *Tufts University (Mass.)*, (C,M,P), M. Kent Wilson, Chemistry Department; **Williams College (Mass.)*, (B), Samuel A. Matthews, Biology Department; *Worchester Polytechnic Institute (Mass.)* (P), Richard F. Morton, Physics Department; **Michigan State University of A & M Arts*, (C,M,P), F. B. Dutton, Science and Mathematics Teaching Center; *Northern Michigan College*, (B,C,GS,M,P), Holmes Boynton, Mathematics Department; *Wayne State University (Mich.)*, (RB), Arthur J. Vorwald, College of Medicine; *Western Michigan University*, (M), Charles H. Butler, Mathematics Department; *Carleton College (Minn.)*, (M), Kenneth O. May, Mathematics and Astronomy Department; *Minnesota, University of (Duluth)*, (B,C,GS,M,P), W. R. McEwen, Science and Mathematics Division; *Minnesota, University of (Minneapolis)*, (P), J. W. Buchta, Physics Department; *Minnesota, University of (Minneapolis)*, (B), William H. Marshall, Zoology Department; *Mississippi, University of*, (B,C,GS,M,P), George Vaughan, Chemistry Department; *Missouri School of Mines and Metallurgy*, (C,GS,M,P), Harold Q. Fuller, Physics Department; *St. Louis University (Mo.)*, (C), Theodore A. Ashford, Chemistry Department; **Montana State College*, (C), L. O. Binder, Jr., Chemistry Department; *Montana State University*, (B,RB), G. B. Castle, Biology Department; *Nebraska, University of*, (C,B,M,P), Walter E. Militzer, College of Arts and Sciences; *New Hampshire, University of*, (C,P), Harold Iddles, Chemistry Department; *Rutgers University (N.J.)*, (M), Emory P. Starke, Mathematics Department; *New Mexico Highlands University*, (B,C), Lora Mangum Shields, Biology Department; *New Mexico, University of*, (RB), Harold O. Ried, Director of the Summer Session; *Adelphi College (N.Y.)*, (C,RB), Howard A. Robinson, Physics Department; *Buffalo, University of, (N.Y.)*, (M), Harriet F. Montague, Mathematics Department; *Cornell University (N.Y.)*, (ES), Richard B. Fischer, Rural Education Department; *Rensselaer Polytechnic Institute (N.Y.)*, (GS), Edwin Brown Allen, Mathematics Department; *Union College (N.Y.)*, (B,C, M,P), George Reed, Chemistry Department; *Duke University (N.C.)*, (RB), Henry S. Roberts, Jr., Zoology Department; *Duke University (N.C.)*, (B,C, M,P), W. M. Nielsen, Physics Department; *N. Carolina College at Durham*, (B,C,M), William H. Robinson, Physics Department; *North Carolina, University of*, (B,C,ES,GS,M,P), Victor A. Greulach, Botany Department; *North Dakota, University of*, (C,GS,M,P), J. Donald Henderson, Physics Department; *Antioch College (Ohio)*, (GS), James F. Corwin, Chemistry Department; *Case Institute of Technology (Ohio)*, (C), R. G. Weast, Chemistry Department; *Oberlin College (Ohio)*, (M), Wade Ellis, Mathematics Department; *Ohio University*, (C,M,P), L. P. Eblin, Chemistry Department; *Ohio Wesleyan University*, (C,GS,P), Howard N. Maxwell, Physics Department; *Oklahoma, University of*, (GS), Horace H. Bliss, 61 Faculty Exchange; **Oregon State College*, (B), Henry P. Hansen, Graduate School; **Oregon, University of*, (B), Robert W. Morris, Biology Department; *Reed College (Ore.)*, (P), Kenneth E. Davis, Physics Department; *Allegheny College (Pa.)*, (B,C,ES,GS,M,P), Robert E. Bugbee, Biology Department; *Bucknell University (Pa.)*, (B,C,GS,M,P), Lester Kieft, Chemistry Department; *Lafayette College (Pa.)*, (C,P), Fred V. Roeder, Education Department; *Pennsylvania State University*, (B,C,ES,GS,P), William H. Powers, Arts and Science Extension; *Puerto Rico, University of*, (GS,M), F. Bueso, College of Natural Sciences; *Brown University (R.I.)*, (GS,M), Elmer R. Smith, Teacher Training; *Converse College (S.C.)*, (B,C, P), H. E. Shiver, Chemistry Department; *State University of South Dakota*, (B,C, GS,M,P), Charles R. Estee, Box 57, University Exchange; *Oak Ridge Institute of Nuclear Studies (Tenn.)*, (C,P), Ralph T. Overman, Special Training Division; *Oak Ridge Institute of Nuclear Studies (Tenn.)*, (P), Ralph T. Overman, Special Training Division; *Tennessee Polytechnic Institute*, (B,C,GS,M,P), G. B. Pennebaker, School of Arts and Sciences; *Baylor University (Texas)*, (B,C,GS,M,P,RB), Bryce C. Brown, Biology Department; *Howard Payne College (Texas)*, (GS,M), Richard A. Eads, Science Division; *Southern Methodist University (Texas)*, (B,C,GS,M,P), Joe P. Harris, Jr., Biology Department; *Stephen F. Austin State College (Texas)*, (B,C,GS,M,P), H. E. Abbott, Chemistry Department; *Brigham Young University (Utah)*, (RB), Lane A. Compton, Physics Department; *Vermont, University of*, (M), N. James Schoonmaker, Mathematics Department; *Virginia Polytechnic Institute*, (B,C,ES,GS,P), Thomas M. Hahn, Jr., Physics Department; *Virginia State College*, (GS), Richard H. Dunn, Graduate Studies and Research; *State College of Washington*, (B,C,ES,GS,M,P), Alfred B. Butler, Physics Department; *West Virginia University*, (C,M,P), J. K. Stewart, Mathematics Department; *Marquette University (Wisc.)*, (B), Rezneat M. Darnell, Biology Department; *Ripon College (Wisc.)*, (GS,M,P), Robert S. Wilson, Physics Department; *Wisconsin, University of*, (M), H. Van Engen, Mathematics Department; *Wyoming, University of*, (B,RB), William B. Owen, Zoology Department; *Wyoming, University of*, (M), W. Norman Smith, Mathematics Department.

For High-School Teachers Only, except as follows: * For College Teachers Only and **For High-School and College Teachers.

• **Drake University, Des Moines, Iowa, has inaugurated a masters degree program for the preparation of teachers for general education courses in biological sciences and in physical sciences.** The curriculum includes three major parts, one, consisting of approximately two-thirds of the hours required for the degree, is devoted to further courses in the sciences. The courses are selected to give some concentration, but also to build the background of the individual in the departments where his undergraduate training was weak. The second part involves apprenticeships in the general education science courses at Drake University and includes extensive staff conferences dealing with the courses taught. The third part of the program consists of professional material to give the prospective teachers and understanding of the place of science in the college curriculum, the history and philosophy of science, the methods of science, and principles of learning and evaluation in science.

The first graduates from this program are expected to be available for teaching positions in the fall of 1959. Assistantships are available which pay $1200 per academic year plus tuition.

• **A research program to investigate the patterns of creativity in the sciences** has been established by New York University's Division of General Education. It will be concerned with the recognition and encouragement of scientific talent. A series of seminar meetings, to begin at New York University early in 1958, is one of the first projects of the program. The participants will be research workers and research managers from government, industry and the University. Using an operational approach, they will seek to arrive at ways of dealing with creativity, to delineate creative research patterns, and to foster interscience research projects. The subject of the first seminar will be "The Role of Conjecture." Participation in the series will be by invitation,

but, according to Dr. Myron A. Coler, Director, interested persons should feel free to write to or phone him at NYU's Division of General Education, Washington Square, New York. Another project of the Creative Science Program will be the establishment of a specialized reference library to collect and codify the extensive but scattered literature pertinent to creativity in the sciences.

In discussing the program, Dean McGhee, of the Division, pointed out three areas in which "the recognition of creative talent and its proper encouragement can be of inestimable value". These, he said are the recognition of talent in young people, the utilization of accumulated unused talent in our aging population, and the discovery of "the area of greatest creativity" in persons with "misplaced" creative talent.

• **For a number of years various educational institutions within the state of Illinois have been cooperatively investigating teaching in the elementary and secondary schools and the preparation of teachers.**

One of several subgroups has been involved with the physical and biological sciences. A report "The Teaching of Science in Illinois Group IV: Physical and Biological Sciences" is available in limited quantities from the chairman of the subcommittee which prepared it: Harvey I. Fisher, Department of Zoology, Southern Illinois University, Carbondale, Illinois.

Biology Library

One copy of each publication submitted for listing should be sent to the Editor, AIBS Bulletin, 2000 P Street, N.W., Washington 6, D. C. Only books published within a year of receipt will be reviewed. Books marked with an ★ are those published by Bulletin advertisers.

ANIMAL SCIENCES

Advances in Pest Control Research, Vol. I. Edited by R. L. METCALF. 514 pgs., illus. Interscience Publishers, 250 Fifth Ave., New York, N. Y. $11.00

This book, representing Volume I in a projected series of review type, discusses and summarizes the progress being made through chemical and biological research in the control of pests. The latter are defined by the Editor as "organisms (from fungi to rodents) that compete with man for his food supply, damage his possessions, and attack his person". It comprises ten papers authored by well known authorities in each of the highly specialized fields which have been well selected for this initial volume. While seventy percent of the papers related to research in the field of insect control, they also discuss the mode of action of chemicals in the control of weeds and fungi, with an interesting explanation of the mechanics of fungitoxicity. With respect to insects, the selected authority thoroughly explains the health hazards presented by residues following the use of pesticides; discusses the use of radioisotopes in following the movement of chemicals within plants and animals in studying the manner in which they serve as effective insecticides; presents a needed, comprehensive, up-to-the-minute, list of chemicals that have been found effective as insect repellents; constructively evaluates organic phosphorus compounds as insecticides; discusses the role and action of systemic insecticides as used in pest control; and treats objectively, current findings in biological and chemical assay methods in the qualitative and quantitative analysis of poisonous residues with a comprehensive presentation of practical methods available for use with respective to the latter. The papers are all well written, adequately supplemented with tables, charts and graphs, and each followed by an extensive reference list. They should satisfy the demands of the most exacting technician and yet invite reading by the laymen seeking the most accurate general information in these fields. The papers are longer than the usual review type which increases their informational content and value. The book is recommended, without reservation, as an invaluable addition to the bookshelf of the biologist, or others, active in the fields covered. *H. M. Armitage, 1617 41st St., Sacramento 19, California.*

★The Vertebrate Visual System. STEPHEN POLYAK. 1390 pgs., illus. The University of Chicago Press, 5750 Ellis Avenue, Chicago 37, Ill. (1957) $45.00

This almost encyclopedic work is a comprehensive description of the organ of vision and of the nervous pathways and centers connected with it in all of the classes of vertebrates. We learn from the Foreword that the author was actually working on this book on the last day of his life. Great credit is due to Heinrich Klüver, Dr. Polyak's long-time friend and colleague, who made possible the completion of the book. An introductory section presents the history of investigation of the eye and the development of the optical sciences and is replete with information concerning the great workers in this field, including, also, pictures from contemporary portraits of many of them. This is followed by a description of investigation in these fields in modern times, again with abundant material on the individual workers. The main body of the subject, the actual description of structure, begins with the Structure of the Vertebrate Retina, which, as might be anticipated from the same author's earlier great work on this subject (1941), is an excellent presentation, again brought up to date with the most recent literature and with magnificent illustrations, many in color. The optic nerves, chiasma, tracts, and subcortical visual centers follow, then the supranuclear division, the functional organizations of the vertebrate visual system, and the blood supply are discussed. An entire section of the book (Part III—130 pp.) deals with clinical and pathoanatomical observations which are particularly pertinent to the understanding of normal structure and function. The section on Biology of the Organs of Sight goes back to the lowest forms of invertebrate life to trace the development of visual organs from the ocelli of single cells. Particular stress is laid on the relation of "way of life" to organization of the visual apparatus; and individual species, their habitat and habits, are used to illustrate points, both for invertebrates and vertebrates. The last section of the book, on Vision and its Role in the Origin of Man is an astute philosophical as well as biological treatise. An extensive Bibliography (in fact, 299 pages!) completes this monumental and classical volume. While this work is a "posthumous" publication, we are told in the Preface that it "—is, to all extents, the book as it left Stephen Polyak's pen and represents in all its details the kind of book he wanted it to be". *Warren Andrew, Bowman Gray School of Medicine, Winston Salem, N. C.*

Guide to the Fishes of New Mexico. WILLIAM J. KOSTER. 116 pgs., illus. University of New Mexico Press, Albuquerque, New Mexico. (1957) $1.00

Sportsmen, conservationists, and amateur naturalists of the Southwest will find that this handbook contains not only a ready means of identifying fish but also some answers to their questions concerning fish distribution, life histories and economic values. Eighty-five species of fish occurring in New Mexico are illustrated by the author's line drawings. The illustrations form a part of the taxonomic keys, hence they will greatly assist identification. The absence of technical language and the author's clear and readable style should encourage the amateur. Introductory sections dealing with fish biology and management deserve mention because they are excellent summaries for the sportsman of contemporary problems in fish conservation. The book is marred in places by creased pages and is deserving of a more handsome printing. These features, however, will not detract from its usefulness as a field handbook. *Frank F. Hooper, Institute of Fishery Research, Ann Arbor, Mich.*

Animals Parasitic in Man. GEOFFREY LAPAGE. 320 pgs., illus. Penguin Books Inc., 3300 Clipper Mill Road, Baltimore 11, Md. (1957) $.95

This paper bound pocket-size Pelican Book is designed mainly as an aid for medical students and others who lack basic

training in the field of parasitology during the college years. It gives a relatively non-technical account of animal parasites which affect man and yet usually follows acceptable terminology and nomenclature. The information is for the most part up to date and draws needed and long overdue attention to the abundance and importance of parasites living part or all of their lives in man. The life history and other illustrations are in keeping with the adequacy and intent of the book. *Lawrence R. Penner, University of Connecticut, Storrs, Conn.*

★Principles of Zoology. JOHN A. MOORE. 667 pgs. Oxford University Press, Inc., 114 Fifth Avenue, New York 11, N.Y. (1957) $7.50

This book should be greeted with enthusiasm by all who teach general zoology or college biology, for the following reasons: (1) It is a well-written account of basic zoological principles; (2) It is effectively illustrated with vivified line drawings and excellent photographs; (3) By means of coherent considerations on the role of ATP, DPN, and cytochromes it shows that living organisms of widely different sorts have common biochemical patterns. The six sections of this book are integrated skillfully: General Features of a Biological System, Genetic Concepts, Embryology, Evolution, Human Physiology, and The Philosophy of Science. Recent findings or new interpretations of the topics are brought to the reader's attention. The author has accepted the fact that students come to college with varied backgrounds but he also seems to assume that they have acquired a degree of intellectual curiosity which will allow them to accept suggested readings in original sources, even in the German language. This is a commendable feature. Although the book is based upon the author's experiences with students whose primary interests are not in science, he has written a book which should find a permanent place in the curriculum of zoology. *Harold E. Finley, Howard University, Washington, D. C.*

Mammals of the Great Lakes Region. WILLIAM H. BURT. 246 pgs., illus. University of Michigan Press, Ann Arbor, Michigan. (1957) $4.75

Although books have been published on the mammals of states (i.e. Colorado, Idaho, Illinois and Wisconsin, Indiana, Kansas, Michigan, Minnesota, Nevada, Utah, and Virginia) this one is devoted to the mammals of a non-political, natural area, a fact which should find approval among biologists. The area selected is a limited drainage area including the Great Lakes. Its limits are not suggested as faunal barriers, but according to Dice (1943. The Biotic Provinces of North America) the boundaries of several biotic provinces pass through it. Since no special effort is made to test, or treat these boundaries, one is left with the impression that the area chosen to be treated in "Mammals of the Great Lakes Region" is the most convenient geographic scope for enlarging the author's 1946 book "Mammals of Michigan". The author, William H. Burt says of his new book, "This is, in fact, a revision of *The Mammals of Michigan*, with species added to include the area surrounding the Great Lakes."

There is implicit in the author's prefatory remarks, furthermore, an unusual restriction of source. He says, "The statements throughout are based, insofar as possible, on specimens and field notes in the Museum of Zoology, University of Michigan. When information from this source was lacking, I have utilized the publications of workers outside this institution." This surprising limitation results, for example, in no citation of the field research on Michigan mammals by the sister institution, Michigan State University. Perhaps it also explains why the new map of the least chipmunk distribution in the area (p. 94) does not include the range published by Randolph Peterson (1953, p. 3), and the new map of the bobcat's range in the Great Lakes area does not include the distribution published by Peterson and Downing (1952, p. 3) of the Royal Ontario Museum.

As a handbook to help novices enjoy vacationing in the area, or high school teachers of the region to enrich their biology courses, this book has attributes. Its freedom from error in text is of a very high order. Its typography is excellent and represents a substantial improvement over the handsome earlier book. The newly prepared maps give the Great Lakes regional distribution of each species and these are accompanied by smaller scale maps showing the species ranges in North America. The little pen and ink sketches of each species accompaning the distribution maps, however, are inharmoniously crude. There is a 30-page illustrative key to the species and three-page glossary which appears usable. The dental formulae constitute a separate three-page chapter in the new book and are thus more easily compared and available as a supplementry check on the key. The book is on the whole admirably planned as an attractive, practical learning instrument, and its low price for such high quality is certainly a credit to author and publisher alike. *Joseph Curtis Moore, American Museum of Natural History, New York.*

★Human Histology. A Textbook in Outline Form. LESLIE B. AREY. 337 pgs., no illus. W. B. Saunders Co., West Washington Sq., Philadelphia 5, Pa. (1957)

"This book represents a new departure in the presentation of histological information" states the author. As an experiment, it is worthy of consideration. Perhaps the author should speak for his new idea. "*Human Histology* is a full-length textbook, standard in scope, unorthodox in treatment and designedly without illustrations. . . . The style adopted is a rigorously followed outline-format. . . . In keeping with the outline form goes a staccato text, mostly of single-line sentences. What may, perforce, be lost in smoothness and grace of style is offset by Baedeker-like concision and force and, it may be hoped, clarity." It is the belief of Dr. Arey that his new text will serve three useful purposes: (1) a companion in laboratory study, (2) the consolidation of knowledge acquired by lectures, slide study, pictures and outside reading, and (3) a review source, "whether the review be cursory or thorough". Only time and the experience of a wide sampling of users will determine the advantages or disadvantages of this innovation.

★Breeding and Improvement of Farm Animals. V. A. RICE, F. N. ANDREWS, E. J. WARWICK and J. E. LEGATES. 537 pgs., 161 figs., 70 tables. McGraw-Hill Book Company, 330 West 42nd St., New York 36, N. Y. (5th edition, 1957) $8.50

In his Preface, the senior author explains the multiplicity of authorship that marks this 5th edition, "The time has arrived when it is well-nigh impossible for one to keep fully abreast of all the new developments and approaches in the scientific phases involved in animal improvement". Therefore, the assistance of F. N. Andrews in the reproductive field and E. J. Warwick in that of animal breeding was sought in a previous edition. The current edition contains sections on variation, population genetics, and dairy-cattle selection by J. E. Legates. The composite treatment has produced a text that is factually sound, extremely comprehensive, and interesting to read. An introductory section deals with the physiology of reproduction, and includes a chapter on artificial insemination. The mechanisms of heredity and variation are considered qualitatively in a second section. A final section on breeding systems and selection discusses related and unrelated breeding, crossbreeding and linecrossing, and devotes a chapter each to the selection of dairy cattle, beef cattle, sheep and swine.

★The Numbers of Man and Animals. Symposium of The Institute of Biology. Edited by J. B. CRAGG and N. W. PIRIE, 152 pgs. Macmillan Co., 60 Fifth Ave., New York, N. Y. (1955) $2.75

This book is a record of a symposium held on September 24-25, (1954), by the Institute of Biology. Its editors state that its aim was to bring together specialists in many different subjects connected with the numbers of man and animals in order to discover how much common ground existed and to emphasize the most serious gaps in our knowledge. Much of this purpose was accomplished by the selection of participants, but the reader is left to ferret out the gaps because no attempt is made to summarize and discuss the presentations. The book includes the views of economists, anthropologists, zoologists and

demographers—presented as a series of independent essays. The discussions that followed are reported at the end of each chapter. The topics include economic theory on population balance, growth of human populations, mortality factors, effects of density on animal populations, the mathematical approach to population dynamics, and a series of papers dealing with the biological, medical and social aspects of human population problems. Much of the recent work on animal populations is discussed by Lack and Chitty but the only reference to insect population studies is a report by Park on his *Tribolium* experimental populations. The failure to include a discussion of the extensive field studies on the dynamics of insect populations leaves a big gap in the coverage. The biologist will find the emphasis placed on human populations. Darling justifies this situation by stating that the chief interest of man is man, and man is a social animal. The various authors approach the human population problem by discussing the importance of disease, birth control, the effects of nutrition on animal and human fertility, and the changes in quality of human populations. The ecologist will find Darling's paper on pastorialism the most original and thought provoking chapter. The conclusion that can be drawn from this symposium is that while the factors controlling the abundance of animals can be found by close study of the physical and biotic environment (including the disturbances caused by man), human population changes are influenced as much or more by socio-economic and medical influences. *A. C. Hodson, University of Minnesota, St. Paul.*

Recovery of Texas-1 Coxackie Virus from the Blood of a Wild Rabbit. JOHN R. O'CONNOR. 17 pgs. Catholic University of America Press, 620 Michigan Ave., N.E., Washington 17, D. C. (1957) $.25

Histology. H. G. Q. ROWETT. 47 pgs., illus. Rinehart & Co., 232 Madison Ave., New York. (1957) $.95

★**Laboratory Workbook for Principles of Zoology.** JOHN A. MOORE. 113 pgs., 20 plates. Oxford University Press, 114 Fifth Ave., New York. (1957) $2.75

A Spectacular Waterfowl Migration Through Central North America. FRANK C. BELLROSE. 24 pgs. Biological Notes. No. 36. Single Copies free to individuals from: Section of Wildlife Research. Illinois Natural History Survey, Urbana, Ill. (1957)

PLANT SCIENCES

Atomic Energy and Agriculture. Edited by C. L. COMAR. 460 pgs. 44 illus. Publication No. 49. American Association for the Advancement of Science, 1515 Massachusetts Ave., Washington, D. C. (1957) $9.50

This book places on record the symposium held on December 27-29, 1955 at the Atlanta meeting of the AAAS, sponsored by the Oak Ridge Institute of Nuclear Studies. Twenty-two chapters under the authorship of 36 scientists cover the different aspects of atomic energy uses in agricultural research. The first five of these chapters are concerned with plant-soil relationships, and the next five with various aspects of plant metabolism. Subsequent chapters cover the uses of radiation and tracer studies in crop improvement, in entomology, in animal nutrition and metabolism studies, and in work on food preservation. The book is thus a documentation of the state of our knowledge of these matters at the end of 1955, and as such is a valuable historical record. All of the chapters are thoughtfully and critically presented and the editorial standards of printing and illustration are unusually high. *Damon Boynton, Cornell University.*

★**Plan Doctoring Is Fun.** CYNTHIA WESTCOTT. 280 pgs. D. Van Nostrand Company, Inc., Princeton, N. J. (1957) $4.50

Here is a chatty running description of the experiences of a woman who, as the depression of 1929 hit the country, found herself with several academic degrees and slim prospects of professional employment commensurate with the training she had acquired. With a taste for adventure and a need for personal independence inherited from her New England forbears, she set out to make her own version of a practicing plant doctor. The "practice" became a hectic but humorous mixture of garden inspections and sprayings, bouts with unpredictable weather and with the vagaries of a much-used Ford, speaking engagements and consultations with innumerable garden clubs and short courses in all parts of the United States, deadlines for writing assignments, meetings with fellow biologists and scientific societies, a tremendous business correspondence, and bits of slapdash cookery for special occasions. This unique plant doctor became plant pathologist, entomologist, horticulturist, gardner, and teacher on a vast scale, using her technical information and skills to keep plants healthy and gardens beautiful for the enjoyment of thousands. Behind her diagnoses of garden ills and her recommendations for plant health were her personal scientific studies in Wellesley and Cornell Universities, in the Bulb Laboratory in Holland, in the azalea and camellia gardens of southern United States, in her own experimental rose garden and her kitchen laboratory in New Jersey. Cynthia Westcott is as well known as "The Rose Lady" as she is as "The Plant Doctor," for appreciating the beauty of the rose and encouraging people to grow roses were as important to her as doing something about rose midge, rose mildew, and rose blackspot. Because she "just talks along" in this autobiography, filling in with a wealth of personalities, because of her fondness for people, slipping in anecdotes on comical situations, adding judicious amounts of scientific material, a reader will enjoy the revelation of her own personality and the great variety of experiences in her life. *Helen Hart, University of Minnesota, St. Paul.*

Forest Fertilization. DONALD P. WHITE and ALBERT L. LEAF. 305 pgs. State University College of Forestry Techn. Pub. 81, Syracuse University, Syracuse 10, N. Y. (1957)

This looseleaf, spiral-bound publication, described on the title-page as "A bibliography, with abstracts, on the use of fertilizers and soil amendments in forestry," is also "World Forestry Series Bulletin Number Two." The handsome plastic covers bear colored illustrations showing, respectively, potash recovery and deficiency in white spruce and magnesium deficiency and normal growth in white pine. The book consists of an authors' preface; an introduction by Prof. Svend O. Heiberg; lists of citation abbreviations, of terms and their abbreviations, and abstract sources; the main bibliography (arranged alphabetically by authors), and a subject index. Preference is given to authors' abstracts when available.

It is not surprising that, aside from nursery practice, forest fertilization until recently has attracted little interest in this country—certainly as contrasted with Europe. Our growing population and increase in values of land and forest products have brought this subject again to attention. The U. S. Department of Agriculture, in its Extension Service Handbook of 1927, published a classification filing key compiled by the Society of American Foresters in which no mention is made of forest fertilization except under Nursery Practice. Munns' voluminous "Selected Bibliography of North American Forestry" (1940) has no section on fertilizing, though some of the citations under "Nursery Practice" are in this field. Of White & Leaf's 700 annotated titles the oldest is 1865, a work by J. K. Koderle of Vienna. Through 1920 there are only 12 titles, while 584 titles (over 83%) date from 1938 on. The compilers pay tribute to Dr. Antonin Nêmec of Prague as "undoubtedly the outstanding contributor to this field" and he is the author of 87 of the articles listed. Obviously this is an invaluable reference to anyone concerned with this growing (and, in this country, relatively new) field of research. *W. A. Dayton, 4818 24th St., Arlington, Va.*

The U. C. System for Producing Healthy Container-Grown Plants. KENKETH F. BAKER. 332 pgs., illus. California Agricultural Experiment Station, Extension Service, Davis, Calif. Manual 23. (1957) $1.00

The Hundred Finest Trees and Shrubs for Temperate Climates. Handbook No. 25. Edited by Garden Committee. 74

pgs., illus. Brooklyn Botanic Gardens, 1000 Washington Ave., Brooklyn 25, N. Y. (1957) $1.00

Plants and Gardens. Handbook on Propagation. LEWIS F. LIPP. 74 pgs., illus. Brooklyn Botanic Garden, 1000 Washington Ave., Brooklyn 25, N. Y. (1957) $1.00

Medical Mycology. Laboratory Manual. E. S. BENEKE. 186 pgs., illus. Burgess Publishing Co., 426 South 6th St., Minneapolis 15, Minn. (1957) $4.00

MISCELLANEOUS

★An Introduction to Probability Theory and its Applications, Volume I. WILLIAM FELLER. 461 pgs. John Wiley and Sons, 440 Fourth Ave., New York 16, N. Y. (2nd edition, 1957) $10.75

This book represents an enlargement of the older work rather than a revision. The first edition has been brought up to date and enlarged by including additional material on the power of combinatorial methods, recurrent events, and general fluctuation theory. The book is restricted to discrete sample space so that the basic concepts of probability theory can be presented from an intuitive background.

The author has starred chapters and sections that require advanced mathematical training. This starring of certain sections enables the less mature student to read the unstarred parts and develop a good appreciation of probability without becoming lost in advanced mathematics. In general, the most elementary part of the book will be too advanced for the average biological student. *Boyd Harshbarger, Virginia Polytechnic Institute, Blacksburg.*

Excited States in Chemistry and Biology. C. REID. 215 pgs., illus. Academic Press, 111 Fifth Avenue, New York 3, New York. (1957) $7.50

The title of this book probably will arouse the curiosity of biologists who have not kept abreast of the more recent terminology of chemistry and physics. The excited states referred to in this book are those of molecules, and the term is used to describe the situation where some of the electrons of a molecule make use of orbits not occupied in its normal or unexcited state. If sufficient energy is supplied to cause a shift in the orbits of their electrons, molecules become unstable and if they collide with other molecules, energy can be transferred or used to cause a reaction. It is possible that many biological reactions are brought about by excited state mechanisms, particularly those initiated by radiation. This includes such processes as photosynthesis, phototropism, photoperiodism, the process of vision, and bioluminescence. Szent-Gyorgi has for some time also held the view that most energy transfer in living organisms is associated with excited states of molecules, particularly those involving proteins and nucleic acids. If, as Szent-Gyorgi claims, the reactive systems of cells are not solutions, but mostly structural solids, then the importance of excited states of molecules is particularly great in biochemical reactions.

Although this book contains two chapters intended for those unfamiliar with quantum theory it may prove rather difficult reading for those with a limited knowledge of modern physics and chemistry. The physical concepts developed in the earlier chapters are applied to such biological phenomena as luminescent reactions, vision, and the effects of high energy radiation in the last three chapters. For those not frightened away by the equations of the earlier chapters this will prove an interesting introduction to what promises to become an increasingly important field, likely to contribute materially to a better understanding of chemical reactions and energy transfer in living organisms. *Paul J. Kramer, Duke University.*

★Soil - Plant Relationships. C. A. BLACK. 332 pgs., illus. John Wiley and Sons, 440 Fourth Ave., New York 16, N. Y. (1957)

As indicated in the preface, the subject matter of this textbook is covered by the author in a course taught at Iowa State College, and is an obvious outgrowth of comprehensive lecture notes accumulated over many years. The level of presentation is for the junior or senior undergraduate with some knowledge and background in soils, plant physiology and the physical sciences. The emphasis throughout is on the soil as a substrate for plant growth, with the plant examples primarily agronomic, although the author has included other crops. The nine chapters follow the usual pattern: soil composition; soil moisture: soil aeration; exchangeable bases; soil acidity; soil salinity and alkalinity; nitrogen; phosphorus and potassium. Why a consideration of nutrient elements ends with nitrogen, phosphorus and potassium is not explained. The author presents and evaluates classic as well as less established current concepts in each chapter and appends an unusually well selected list of supplementary references. Literature citations occur of unpublished papers and research studies (Ph.D. Theses) heretofore little known beyond Iowa State College. Their use, however, does not imply provincialism in the outlook of the book as a whole. Illustrations and tables are well selected and assist in the author's objective of "integrating the properties of soils with the responses of plants". *S. H. Wittwer, Michigan State University, East Lansing.*

★Scientific French. WILLIAM N. LOCKE. 112 pgs. John Wiley & Sons, 440 Fourth Avenue, New York. (1957) $2.25

The graduate student looking for a simple way of "boning up" for necessary language exams or acquiring a reading knowledge of French, will find this small compact, loose-leaf book worth investigating. A dictionary will still be necessary for vocabulary but many a seeming grammatical idiosyncrasy will be cleared up in *Scientific French*. A similar volume in German appears below.

★Scientific German. GEORGE E. CONDOYANNIS. 164 pgs. John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y.

The Patient Speaks. HAROLD A. ABRAMSON. 239 pgs., Vantage Press, 120 West 31st St., New York 1, N. Y. (1956) $3.50

The Patient Speaks is a study, from actual transcriptions, of a patient's progress as she undergoes "ego reconstruction" through the psychoanalytical technique. Alice, the patient, sought medical attention originally for an allergic skin condition and was cured by unearthing a deep-seated daughter-mother relationship. The physician-patient interviews, covering a period of several years, were wire-recorded. The present publication contains the relevant parts of this recording along with interpolated remarks by Dr. Abramson explaining the steps in recovery. Free from confusing technical terminology, the book should prove absorbing to the non-psychiatric layman who is constantly being analyzed by advertising and well-meaning friends.

Expectant Motherhood. NICHOLSON J. EASTMAN. 198 pgs., illus. Little, Brown & Co., 34 Beacon St., Boston 6, Mass. (3rd edition, 1957) $1.75

This is not a scientific volume. Its review in this column will be limited to saying that, if needed, this small book offers calm, easily understood instructions and advice. Extremely practical, it contains details about diet, "symptoms" month by month, appropriate clothing for the mother, and the latest in layettes. A once-over should reduce unnecessary calls to the doctor.

Physiology of Prematurity. Edited by JONATHAN T. LANMAN. 151 pgs., illus. Josiah Macy Jr. Foundation, 16 West 46th St., New York, N. Y. (1957) $3.25

Containing the transactions of the First Conference on the Physiology of Prematurity, held March 1956 at Princeton, N. J., this volume offers three papers and the group exchanges that follow each: Introductory Remarks, Clement A. Smith; Fetal - Maternal Endocrinology in Late Pregnancy, Jonathan T. Lanman; and the Fetal and Placental Circulation in Late Pregnancy, Geoffrey S. Dawes. In his introductory remarks the Chairman, Clement A. Smith, says "It is the purpose of these conferences to generate ideas to take home and think about".

★**The Healing of Wounds.** MARTIN B. WILLIAMSON. 202 pgs., illus. McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. (1957) $7.00

Two levels of research approach have been made to wound healing in recent years, "biological" and "molecular". In many areas the two methods fuse. In order to help bring both viewpoints together, a symposium on the healing of wounds was held at the Stritch School of Medicine, Loyola University, Chicago. This small volume presents the papers given during the symposium: Metabolism of Proteins and Amino Acids during Wound Healing, M. B. Williamson; Role of the Ground Substance in Wound Healing, H. R. Catchpole; Methionine in Wound Healing during Protein Starvation, L. C. Edwards and J. E. Dunphy; Pharmacologic Considerations of Sulfur Compounds in Tissue Regeneration, C. D. Proctor; Vitamin C and Wound Healing, H. J. Fromm and R. C. Nordlie; Hormonal Influences on Granulation Tissue Formation, M. Taubenhaus; Collagen in Wound Healing, E. P. Marbach; Healing of Muscle Tissue, D. S. Jones; Incisions Used in Gynecology, H. E. Schmitz; Clinical Approaches to the Concepts of Wound Healing, H. B. Haley.

★**Meredith's Science of Health.** WARREN H. SOUTHWORTH and ARTHUR F. DAVIS. 492 pgs., illus. McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. (3rd edition, 1957) $5.00

In preparing a new edition of Meredith's widely used health book, the authors retained the basic organization of earlier editions, but brought many chapters (parenthood and reproduction) into line for college students of today and added many new topics. Among the latter are: radioactive fallout, chemical warfare, biological warfare, eye hygiene and television, emergency action to save lives, and community forces for health. Four puzzling modern health problems are dealt with for the first time—epilepsy, muscular dystrophy, multiple sclerosis, and cerebral palsy. New information is presented on cancer, alcoholism, heart diseases, and the use of narcotics. The book is scientifically accurate, does not under-rate the intelligence of young college students, and impresses without dictating.

★**The Visual Pigments.** H. J. A. DARTNALL. 216 pgs., illus. John Wiley & Sons, 440 Fourth Ave., New York, N. Y. (1957) $6.00

The author, who is Head of the Visual Research Division, Institute of Ophthalmology, England summarizes our current knowledge of visual pigments with a succinct vocabulary and martial precision. Seven chapters divide the review into I. Introduction and Methods; II. The Visual Pigments and Their Photoproducts; III. The Physical Chemistry of Visual Purple; IV. The Structure of Visual Purple; V. Isomerism and Visual Pigments; VI. The Homogeneity of Visual Pigment Solutions; and VII. Other Methods of Studying Visual Pigments. Tables and graphs amply illustrate the text material. The author states quite early, "It is not the purpose of this book to deal with the visual aspects of the visual pigments, but to describe their physical and chemical properties and the methods which have been used to determine them". This he does with dispatch.

★**Histological Technique.** H. M. CARLETON and R. A. B. DRURY. 343 pgs. Oxford University Press, 114 Fifth Ave., New York 11, N. Y. (3rd edition, 1957) $7.50

The senior author, one of Britain's outstanding pathologists, died shortly after he completed this revision. The edition competently discusses the chief methods employed in the microscopical examination of human and other mammalian organs. First, the fundamental processes of fixation, embedding, section-cutting and staining receive attention. A second section provides workers with accessory and special methods, especially for various organs and tissues. The third part of the volume deals with methods for the identification of morbid changes, or parasites of various sorts, in tissues. Methods for examining body fluids and dejecta for parasites are also given. In "Notes" the author includes a great many "tips", without which most histologists could not produce successful results. A short and general list of references is appended.

★**Handbook of Toxicology. Vol. II. Antibiotics.** Edited by WILLIAM S. SPECTOR. 264 pgs. W. B. Saunders Co., West Washington Square, Philadelphia, Pa. (1957)

Volume II of the *Handbook of Toxicology* supplies chemists, biologists, and pharmacological research workers with a tremendous compilation of data on antibiotics . . . information on 339 compounds to be exact. As is customary in these Handbooks the material is given in tabular or graph form with a minimum of concise verbalization. The data was compiled from the literature by John N. Porter and Gilbert C. DeMello, under the Direction of the Committee on the Handbook of Biological Data, Division of Biology and Agriculture, of the National Research Council.

★**Experiments in Biochemical Research Techniques.** ROBERT W. COWGILL and ARTHUR B. PARDEE. 189 pgs. John Wiley & Sons, 440 Fourth Ave., New York. (1957) $3.50

As the title implies, this book contains a collection of laboratory experiments in biochemistry. The selection has been made for first-year graduate students. The need for such a course was based on the fact that learning from others or by himself, is time-consuming and inefficient for the busy, research-minded, graduate student. The result often is a hesitation to take time to learn new methods and the adherence to familiar techniques. In this manual experiments usually performed in basic biochemistry courses have been omitted, as have experiments requiring elaborate equipment (such as ultracentrifugation and boundary electrophoresis), microbiological and hormone assays, and nutritional experiments. Experiments based extensively on organic synthesis or degradation also were not included. Section headings are: Physical Chemical Methods for Separation and Identification of Biologically Important Compounds; Biochemistry of Enzymes; and Radioactive Isotope Tracer Techniques in Biochemical Research. The authors have attempted to develop a "research attitude" through these experiments by making the students "acquire some of the details from their own reasoning and ingenuity or from references to the literature".

Comparative Physiology of the Nervous Control of Muscular Contraction. GRAHAM HOYLE. 147 pgs., illus. Cambridge University Press, 32 East 57th St., New York 22, N. Y. (1957) $3.00

The Cambridge University Press, through its Cambridge Monographs in Experimental Biology, is performing a fine service to teachers and advanced students in zoology, botany, physiology and biophysics. These small volumes accurately and concisely summarize special research areas or limited fields of knowledge. In this book a comparative treatment is given to the nervous control of muscular contraction. Logically traced from the histological details of innervation in different phyla to the evolution of neuromuscular mechanisms, the story concludes with a formulation of the major problems that remain to be solved. The author is Lecturer in Zoology at the University of Glasgow.

★**The Principles of Heredity.** LAURENCE H. SNYDER and PAUL R. DAVID. 507 pgs., illus. D. C. Heath and Co., 285 Columbus Ave., Boston 16, Mass. (5th edition, 1957) $6.25

Probably the best known and most widely read of introductory genetics texts, *The Principles of Heredity*, now appears in fifth edition. The science of heredity, like all others, is accumulating data more quickly than it can be assimilated . . . particularly into books. The two authors, in this current revision, add a completely new chapter on the genetics of bacteria and viruses. This chapter has been correlated with the textual material on cytoplasmic inheritance and on genes and development—the three chapters forming an integrated unit following the discussion of genes and mutations. The phenomenon of pseudollelism has become one of major interest, so a discussion of this topic is included in Chap. 26. Reworking of the chapter on giant chromosomes has produced two, one dealing with variations in the numbers of

chromosomes, and the other with arrangements of chromsomal material. The chemical structure of desoxyribose nucleic acid, recently determined by Watson and Crick, is neatly outlined and the genetic implications discussed. As before problems are given at the end of each chapter. *Principles of Heredity* will doubtless continue to be a favorite means of introducing young biologists to the science of genetics.

Biological Aspects of the Transmission of Disease. Edited by C. HORTON-SMITH. 184 pgs. Hafner Publishing Co., 31 East 10th St., New York, N. Y. (1957) $4.00

Twenty-two authors contributed to this volume, originally presented as a symposium of the Institute of Biology, England. One of the aims of the Institute is "to break down so far as possible, the professional and specialist barriers that have hitherto hindered the dissemination of knowledge and exchanges of views among workers engaged in allied biological fields." In line with this botanists, zoologists, medical and veterinary scientists were invited to participate. Subjects discussed range through pathogenic fungi, bacterial plant pathogens, fungal diseases of plankton, algae, pathogenic amoebae, transmission of coccidia, veterinary helminths, insect and seed transmission of pathogens, to trypansome, haemosporidia, schistosomiasis and filarisis transmission. Discussions are grouped in a special section at the end of the volume—a practice that does not make for continuity of thought.

★Reading the Landscape. MAY THEILGAARD WATTS. 230 pgs., illus. The Macmillan Co., 60 Fifth Ave., New York, N. Y. (1957) $4.75

This fascinating, meticulously edited, and well documented introduction to ecology, although aimed at the layman, is written for those who want a deeper understanding of our natural environment. Each of the thirteen chapters deals with a different aspect of ecology, ranging from the deciduous forest and the prairies to hydrarch succession, pollen stratigraphy, altitudinal zonation, and finally "fashions" in horticulture. Written from the point of view of "reading the landscape", the chapters are "records and interpretations written by sun and shade, by wind and rain and fire, by time and by animal." The book is effectively illustrated with line drawings by the author. *Robert B. Platt, Emory University, Ga.*

Biology of Aging. Edited by W. B. YAPP and G. H. BOURNE. 128 pgs. Hafner Publishing Co., New York, N. Y. (1957) $4.25

This volume is the written record of a symposium on the subject held at the University College in London in 1956. Each brief chapter represents a short talk (and the recorded discussion which followed each presentation) on a wide variety of subjects concerned with aging, from bacteria to higher plants to vertebrates, including man. This short report should prove helpful as a source or references in a variety of areas in the field of gerontology, rather than serve as an introduction to the subject of the general field of aging for the beginning student. *Morris Rockstein, New York University College of Medicine.*

Oligophrenia in Combination with Congenital Ichthyosis and Spastic Disorders: A Clinical and Genetic Study. TORSTEN SJÖGREN and TAGE LARSSON. 112 pgs., illus. Ejnar Munksgaard, Copenhagen. (1957)

This monograph reports an intensive clinical and genetic investigation of 28 cases of a syndrome not previously described in the medical literature. This condition is characterized by severe mental retardation, congenital ichthyosis, and spastic diplegia of the type characteristic of Little's disease. In addition, three of the patients were found to have a degenerative eye lesion, with the generation of the pigment epithelium in the region of the macula. The clinical picture is quite distinctive. Extensive biochemical and serologic examinations of a few patients failed to demonstrate any abnormalities. The life expectancy of affected individuals is approximately one-half of normal.

Study of the families showed that the 28 original cases fell into 17 families, and five additional cases were discovered by study of these families. With only three exceptions the parents of the patients were born in a restricted area of one county in the north of Sweden. Genetic analysis of the pedigrees demonstrated that the affected individuals are homozygous for an autosomal recessive gene. The investigators felt that for most of the patients the pathologic gene could be traced to a common source, possibly a single mutation, but also that the same gene probably arising by independent mutation was present in other parts of Swedish population. It was estimated that approximately 1.3 percent of the population of Västerbotten County was heterozygous for the gene, but that the prevalence of the gene was presumably less than 0.0005 for the entire Swedish population. *C. Nash Herndon, Bowman Gray School of Medicine.*

Heredo-Retinopathia Congenitalis Monohybrida Recessiva Autosomalis: A Genetical-Statistical Study. CARL HENRY ALSTRÖM and OLOF OLSON. 177 pgs. Berlingska Boktryckeriet, Lund, 1957.

This monograph reports detailed clinical and genetic investigations of 105 families containing 175 children with congenital blindness of a type not previously well defined. The proband cases were obtained from among the students at the Swedish school for blind children, and included those with a diagnosis of congenital "retinochoroiditis" and also those with a diagnosis of amaurosis or amblyopia congenita without known cause.

The investigators present impressive evidence to show that this group of cases with rather wide variation in clinical findings actually constitutes a single genetically determined nosologic entity. The condition is characterized by severe visual disability, probably congenital and recognized during the first year of life. Many affected children show no demonstrable fundus changes (28 percent of those under 15 years of age), but changes in the fundus are slowly progressive and are found in 95 percent of patients past age 45 years. Cataract is found in 10 percent of patients under age 15, and the incidence increases with age to 30 percent in those past 45 years. Keratoconus is also found in about 5 percent of children, and also increases in incidence to about 30 percent in those over age 45. Nystagmus was found in practically all cases. There was no evidence of tubular vision in those with visual acuity sufficient to permit testing.

Genetic analysis of the sibship data by three different methods gave a good statistical fit to the hypothesis that the affected individuals were homozygous for a mutant autosomal recessive gene. Genealogic investigation showed that at least 29 of the 105 families belonged to 5 large kindred complexes. The parents of affected children were first cousins in 16 percent of cases. The mean coefficient of inbreeding was calculated to be 5 to 10 times higher than that of the general Swedish population. The frequency of the trait in the general population of Sweden was estimated at about 3 in 100,000, but this accounted for nearly 10 percent of children admitted to the school for the blind. *C. Nash Herndon, Bowman Gray School of Medicine.*

★Dictionary of Scientific Terms. JOHN H. KENNETH. 523 pgs. D. Van Nostrand Co., Inc., Princeton, N. J. (6th edition, 1957) $12.50

A reference work that has gone through a number of editions—with continuously revised and expanded text—is almost certain to have proved its worth. This dictionary, within its limitations, is no exception. The title, however, is broader than its actual content, which is drawn chiefly from the biological and allied sciences: anatomy, botany, cytology, embryology, genetics, physiology, zoology and, to a much lesser extent, bacteriology and paleontology. An earnest effort has been made to keep abreast of new words, e.g. "abience." "biomass," and acquired meanings of old ones. Scientific, generic, ordinal, and systematic names of plants and animals have, for the most part, been omitted. But why include "diagnosis", "facial", "leaf", and other non-technical words?

The lucid definitions (sometimes overly concise or so insufficiently defining as to require resort to other dictionaries), cross references, abbreviations, equivalent units

of measurement, pronunciation (some effort has been made here and in orthography to take cognizance of American usage) etymologies (occasionally incorrect) are in general well up to standards for science lexica. An especially valuable feature is the suggestion for many adjectives of the typical nouns or phrases to which they are frequently applied. The fact that 14,000 entries cover as vast an area as they do indicates the main inadequacy of the volume for advanced students of the biological disciplines. However, beginners, the growing number of linguistically competent science translators who lack subject matter expertness, and "hybrid" scientists will find it a handy, quick reference tool worthy of a place alongside their Webster's and other frequently consulted books. *Sidney Glazer, 7505 Clarendon Road, Bethesda 14, Md.*

Handbook on Mulches. Handbook No. 23. PAUL FRESE. 73 pgs., illus. Brooklyn Botanic Garden, 1000 Washington Ave., Brooklyn 25, N. Y. (1957) $1.00

Darwinism. Reaction or Reform? BERT J. LOEWENBERG. 60 pgs. Rinehart & Co., 232 Madison Ave., New York 16, N. Y. (1957) $.75

The Biotic Communities of Greenbrook Sanctuary. STEPHEN COLLINS. 112 pgs., illus. Palisades Nature Association, Box 230, Englewood, N. J. (1957) $2.50

Know Your Affiliates

INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH. The next meeting of the International Association for Dental Research will be held in Detroit at the Statler Hotel on March 20-22, 1958. The Association was founded by William J. Gies in December, 1920 in order "to promote broadly the advancement of research in the related phases of the sciences that contribute directly to the development of oral health service." This is part of the preamble to the Association's constitution. However, up to now, the activities of the Association have been devoted principally to: (1) the conduct of the *Journal of Dental Research;* (2) holding meetings at local levels for the presentation and discussion of research projects, especially in the larger sections, such as Chicago, New York, Washington and a number of other places; the organization anl operation of annual meetings for the oral presentation of significant results or of projects ready for publication. The first sizable general meeting was held in Washington, D. C., March 25-28, 1927. There were five scientific sessions and the total number of presentations was 47. At the time of this meeting there were 153 members of whom 69 were elected to membership at this meeting. The total attendance was less than 100. The 1957 meeting was held in Atlantic City, N. J. on March 21-24, and the four day program included three general meetings and 25 scientific sessions with as many as four simultaneous sections on a single half day or evening. The subject section classifications were in the order of the program: Nutrition and Calcification, Fluoride Metabolism, Tooth Enamel, Methods and Instruments, Periodontium, Saliva, Tooth Surfaces and Fluorides, Dental Pulp, Miscellaneous, Bacteriology, Dental Materials, Salivary Glands, Neoplasms and Inflammation, Experimental Animal Caries, Biophysics and Pharmacology, Epidemiology, Histology and Human Growth Patterns and Transplantation. Of these 270 program items, 131 were presented by members of the Association and 139 by nonmembers. In addition 36 were read by title. The registered attendance were 656 and the current membership is approximately 901 of which 787 reside in North America; the others for the most part live in Britain, Denmark, Finland, Germany, Norway, Austria, Latin America and Israel. The 1956 volume (Vol. 35) of the *Journal of Dental Research* includes 6 issues, totaling 980 pages, with 126 separate research projects. The Editor is Hamilton B. G. Robinson of Ohio State University. The president of the Association is Reidar F. Sognnaes of Harvard University and the Secretary-Treasurer is Dan Y. Burrill, Northwestern University, whose address is 311 E. Chicago Ave., Chicago 11, Illinois.

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AT THE present time there are five broad areas in which the biology student may receive the special Woods Hole brand of summer training, namely, Invertebrate Zoology, Physiology, Embryology, Marine Botany and Marine Ecology. Although environmental problems have always received much attention at Woods Hole, ecology has only recently been incorporated into the course program. Since the beginning of the course six years ago, the basic principles of ecology have been stressed. The marine environment, to be sure, is emphasized but all of the major principles, and many of the important technics as well, apply equally to terrestrial and freshwater environments. During the past few years ecology has emerged from a primarily descriptive subject to one which is becoming more and more functional in approach. Marine workers have been leaders in this trend. Since the subject matter of ecology includes all three "functional kingdoms" of the living world, namely, the green plants (producers), the animals (consumers or ingestors) and the "microorganisms" (decomposers or absorbers) and their relation to one another and the physico-chemical environment, it is evident that so long as a purely descriptive viewpoint is maintained there is very little in common among such diverse components. However, all three "kingdoms" are always intimately associated functionally in ecological systems according to well-defined principles. Thus, the only kind of general ecology is a "functional" ecology, and this is the kind of greatest interest to all students of the subject regardless of present or future specialization.

At Woods Hole, botanists, zoologists, microbiologists, biological oceanographers, etc. are closely associated in bringing to the student the over-all principles. At the same time the large "staff" (instructors, consultants, special lecturers) insures that such details of major components as are necessary for proper understanding of principles, are not neglected. By following the "ecosystem approach" (for further discussion of this approach in teaching see the author's note in: Ecology 38: 531-535. 1957) the unity of the material is maintained despite the varied approaches of the different teachers.

The first week of the course is devoted to a review of basic principles in order to orient everyone (undergraduate, graduate and staff alike!) to the framework in which special problems can be logically placed. A study is made on a marine pond in which the major units of a complete ecosystem are sampled and standard quantitative methods of biological and chemical analysis are demonstrated. During the next several weeks ecological components, such as phytoplankton, zooplankton, bottom fauna, decomposers, fish, nutrients, etc. are considered in terms of their composition in various habitats and in relation to basic cycles of matter and the flow of energy. Species-numbers relationships, productivity and its measurement, limiting factor analysis, mathematical models in population ecology, role of growth substances in nature, use of radioactive isotopes in community metabolism studies, intertidal zonation, dynamics of ocean currents, and deep scattering layers in the sea are examples of specific, current topics considered. Field work and field problems in which laboratory and experimental methods form a coordinated part are emphasized. Each student is expected to develop a major field of interest and to complete a special problem in which full use is made of appropriate technics. Since one of the primary aims is to stimulate a research interest in ecology, student problems are written up in standard journal form and reported on orally at the end of the session. Often the problems are sufficiently complete to merit publication.

Alfred Redfield and Paul Galtsoff were among those who first saw the instructional possibilities of such a program. Six years ago the Marine Ecology course was formally organized with Bostwick Ketchum of the Woods Hole Oceanographic Institution in charge and Charles Jenner of North Carolina and E. T. Moul of Rutgers as the other instructors. Following the Woods Hole tradition of changing staffs at intervals the author was asked to take charge for the next several years. In the summer of 1957 John Ryther of WHIO joined the staff and E. T. Moul kindly agreed to serve one more year to insure continuity. Each summer a dozen or more persons visiting or in residence give lectures or demonstrations and many others contribute ideas informally. The present staff especially wishes to invite persons from the advanced undergraduate to the post-doctoral level to apply to the Woods Hole Marine Biological Laboratory for admission to the program regardless of whether they have had previous experience in the marine field or previous courses in ecology or not.

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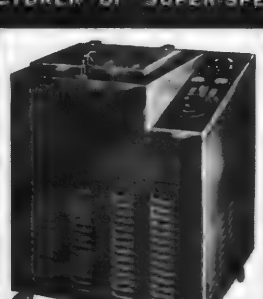

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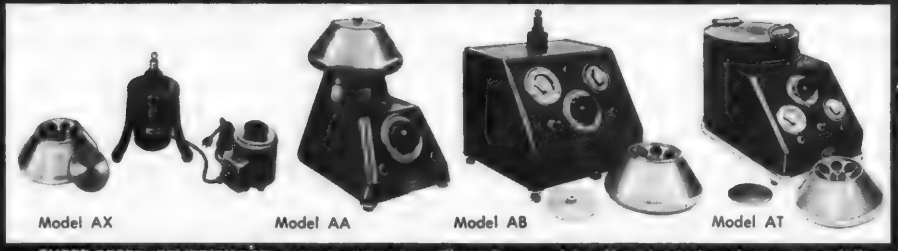

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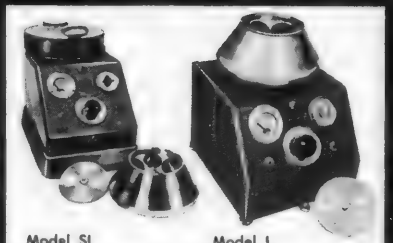

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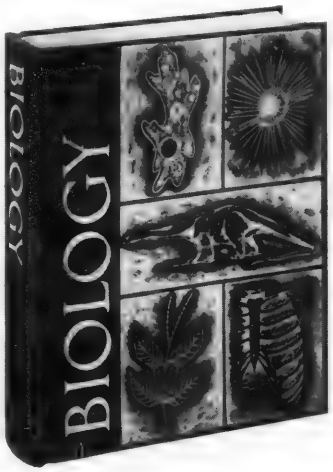

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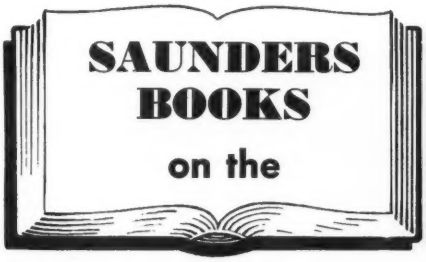

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